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New Research

The Effect of an Acquirer's Life Cycle Stage on the Performance of M&As: Evidence from Mega and Non-Mega Deals in the US

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The Effect of an Acquirer's Life Cycle Stage on the Performance of M&As: Evidence from Mega and Non-Mega Deals in the US

Abstract

A substantial body of academic literature continues to investigate whether M&A deals create or destroy shareholder value and what are the main determinants of M&A performance, but the results are still inconclusive. In this paper, we investigate the impact of corporate life cycle on M&A performance from the perspective of acquiring firms.

We shed additional light on the performance of M&A deals from the perspective of bidders' life cycle stages and the deal size . We single out mega deals, where activity remains upbeat, and compare their effects on M&A performance with the effect of non-mega transactions. In contrast to previous studies in the area, we identify four life cycle stages (introduction, growth, maturity and decline), whereas the existing literature mostly focuses on three life cycle stages.

Our sample includes 2413 US domestic M&A deals from 2003 to 2017, and consists of 386 mega deals and 2027 non-mega transactions. The data for analysis were obtained from Capital IQ, Bloomberg and Thomson Reuters Eikon databases.

Based on the event study method and regression analysis, we find that stock market reaction is positive for M&A deals in the US and this reaction is more favourable for non-mega acquisitions than for mega M&A deals. We show that non-mega deals outperform mega transactions for acquirers at the introduction and growth stages of the business life cycle. Our results also indicate that benefits for shareholders from acquiring firms decrease on average with the lifecycle of an organisation, but the returns for shareholders are positive in both cases. By contrast, in mega deals, shareholders receive negative returns when the acquiring firm is at introductory life cycle stage.

The scientific novelty of this paper is reflected in our contribution and expansion of the scope of research in this field. There is a relative scarcity of analysis examining M&A deals from the perspective of life cycle stage, and our addition of a fourth category of analysis in this area, along with a focus on the value of the deal, expands the range of methodology for future research. This research is open to further expansion in different markets and our methodology is readily adaptable for the addition of further analytical variables. Importantly, with the validation of our research hypotheses and the confirmation of significant results, we provide a useful new tool for managers and professionals engaged in M&A deals to actively gauge and forecast practical implications of their deals.

Keywords: Mergers and Acquisitions, Value Creation, Life Cycle of organisation (LCO), Life Cycle stage, Mega deals

JEL-classification: G34, G14

Introduction

The rise in M&A activity over the past several decades has led to levels of intense research into M&A impact on company performance. Within this context, debates touch two main issues: whether M&A deals create or destroy firm value, and what are M&A performance drivers. However, empirical evidence on these questions remains controversial and inconclusive.

One possible explanation for the observed ambiguity in research findings suggest that M&A performance and its determinants vary according to a company's organisational (or corporate) life cycle (LCO). Researchers have analysed various aspects within the organisational life cycle framework. However, studies of the impact on M&A performance are limited. As far as we know, there are no investigations on deal performance determinants across different stages of LCO. Indeed, life cycle seems to play a crucial role in M&A outcomes. Across life cycle stages, firms demonstrate particular financials, strategies, and organisational structure. Thus, a company's financial and non-financial features change with LCO stages, which may potentially affect both M&A performance and its determinants.

There are only a few studies which explore the relevance of LCO to M&A performance. Owen and Yawson (2010) reveal that cumulative abnormal returns (CARs) levels in US deals decline over the course of the corporate life cycle, while Arikan and Stulz (2016) prove this effect only for private M&As [1; 2]. Chuang (2017) claims that financial advisors can bring higher returns to growing and mature companies, while there is no reward for firms at the stage of stagnation [3].

In this paper we expand the discussion of the impact of LCO on M&A performance in the US and contribute to the existing literature in two ways. First, we separate the acquirer's life cycle into four stages (introduction, growth, mature, decline), whereas previous studies mostly focus on three stages [1–3]. Second, we assess the effect of acquirer's life cycle stage on M&A performance, controlling for the question as to whether a deal is a mega deal or non-mega one. According to Alexandridis et al. (2010, 2013) mega deals destroy value for an acquirer on a greater scale compared to non-mega ones, mostly due to overpayment and difficulties with integration. But these reasons may also depend on the LCO stage of the acquiring company [4; 5].

The remainder of this paper is organised as follows: Section 2 presents the summary of relevant literature and develops testable hypotheses. Section 3 defines the methodology. Section 4 describes the sample selection procedure. Section 5 presents the results, and Section 6 concludes the study.

Literature review and hypotheses

Corporate life cycle concept

The lifecycle of a firm includes the set of break-even moments in the company's business. In particular, across their entire lifecycle, firms face different problems, opportunities, barriers, anomalies and decision types. Given this state of affairs, an analysis of any firm's situation should be applied in relation to the corresponding stage of the lifecycle. It is common to separate the lifecycle into four main stages – introductory, growth, maturity and decline [6; 7].

At the introduction stage, the firm experiences lack of knowledge about the industry [8], while excess managerial optimism might lead to quite high investment rates. Additional debt financing may be needed but may not be available due to particular financial constraints. When the company moves to the growth stage, the period of profit margin maximisation starts. The company maximises its cash flows and becomes rich in its own resources, so financial constraints are not the most relevant problem anymore [9]. At the maturity stage a firm already possesses an appropriate level of knowledge regarding the industry, which helps it to boost the efficiency of operations [10]. As the investment rate starts to decline gradually, the necessity of debt financing diminishes over time [9], while owners demand funds to be distributed. Finally, at the decline stage the company's growth rates start to decline and the firm experiences high organisational inertia, becoming very inflexible in terms of decision making [11; 12], and the company's assets enter the liquidation process. Thus, companies at different corporate life cycle stages are subject to different decisions, have different opportunities, and operate under different circumstances. Company financial and non-financial features change with LCO stages, which may potentially affect both M&A performance and its determinants.

LCO effect on M&A activity and performance

An analysis of academic and professional literature that connects the corporate life cycle concept and M&A deals allows for differentiation between two major streams of research. The first examines the impact of an acquirer's LCO stage on the probability it will engage in an M&A deal. The second stream reveals the effect of an acquirer's LCO stage on M&A performance.

The research was pioneered by Owen and Yawson (2010), who examined 1,934 US bidders from 1991 till 2005 [1]. The authors identify the LCO stage based on Retained Earnings/Total Assets and Retained Earnings/Total Equity indicators, separating all acquirers into three groups – young, mature, and old firms. The results suggest that the probability of M&A engagement follows an inverted U-shaped pattern over the firm's lifecycle: firms in their early years do not possess the sufficient amount of funds needed for deals while old firms may not be engaged in deals due to high level of inflexibility in the process of undertaking decisions. However, M&A performance, (approximated by value weighted CAR over (–2; +2) and (–1; +1) windows), demonstrates different dependence on the LCO of an acquirer as abnormal returns due to the deal are negatively related to the lifecycle stage.

Analysing a more extended sample of US deals from 1981–2012, Arikan and Stulz (2016), in contrast to previous authors, find that the acquisition rate follows a U-shaped pattern over the lifecycle. The authors also state that young firms have higher probability to buy private targets. Using the event study method to assess the performance of M&A deals, the authors argue that public M&As are not beneficial at all stages while the wealth effects of private M&As decline over an acquirer's corporate life cycle stages [2].

The study provided by Partin and Vasin (2014) extends the research to emerging markets, performing an analysis of 6,374 observations from the BRICS group of countries from 2010 till 2013. Antony and Ramesh (1992), applying a more sophisticated ranking approach to the LCO stage identification (3 stages are under consideration – growth, maturity and decline), the authors claim that the probability of being engaged in M&A deals is lower for mature and declining companies than for growing firms. The authors also discover that the size of a company and its profitability have a positive impact on the probability of being engaged in M&A deals across the whole lifecycle. The market-to-book ratio and agency costs demonstrates such an effect only in the case of mature companies and leverage only has a negative impact on such probability in the case of growing firms [13].

In contrast to the previous studies Chuang (2017), concentrates on the deals in which the financial advisors are hired. Analysing 919 deals performed in Asia Pacific over 1995–2014, the author claims that financial advisors can bring higher returns to growth and mature companies. Growing companies receive the highest reward for hiring financial advisors, while there is no reward for hiring financial advisors at the stage of stagnation [3].

Overall, the review of corporate life cycle effect on M&A performance clearly illustrates that there is a potential link between the efficiency of deals and bidder life cycle stages. While research is scarce, the reviewed papers are limited in terms of analysis of particular markets and the presence of methodological drawbacks which do not allow making an exact conclusion on the LCO effect. Thus, the question of association between LCO stages and M&A performance remains open. Within this environment, there is a call for more detailed research that will broaden our understanding of M&A performance.

Performance of mega and non-mega deals

Over the past several years both academic and business researchers have been interested in comparisons of M&A deal performance concerning mega deals and non-mega transactions. Mega deals are typically defined as deals priced over $500 mln – $1 bln [5]. Business press representatives have already pointed out that these mega deals destroy value for an acquirer on a greater scale compared to non-mega ones. For instance, The Financial Times points out that mega deals destroy value for all deal participants except executives and financial advisors [14]. Willis Towers Watson (2016) reports that mega deals are the only deal type that had negative average return value for acquirers in 2016 [15].

Academia has also provided some empirical evidence on the issue of differences in M&A performance between mega and non-mega deals. The classical finding here is that mega deals bring significantly lower returns to acquiring shareholders compared to non-mega ones. Alexandridis et al. (2010) and Alexandridis et al. (2013) analyse the US market and come to conclusion that mega deals destroy value, explaining that economic benefits implied in the price paid are often very hard to achieve [1, 2]. However, the most recent research of Alexandridis et al. (2017 [1]) and Alexandridis et al. (2017 [2]) point out that some positive shift in the performance of US mega deals can be observed, which can be attributed to the changes in corporate governance practices after the 2007–2008 financial crisis [16–18].

There are several reasons that explain these findings. The first one is that such deals tend to imply overpayment. While engaged in a mega deal, an acquirer should conduct deeper analysis, however, managers tend to be overoptimistic and overestimate the future integration benefits. The overpayment can also arise from the large cash flows of an acquiring company, which results in huge investments in the projects with not very high returns. The second group of reasons relates to difficulties in integration: obviously, it is more challenging to integrate a huge company with its own complicated structure, business processes and corporate culture than a small start-up. Considering the foregoing, it is important to differentiate mega and non-mega deals in research with a great number of mega deals in a sample.

The idea of connections between the corporate life cycle concept and whether a mega or non-mega type of a deal applies arises from the intuitive reasons why mega M&A deals often fail. One of the reasons is possible overpayment. As an acquirer matures, it collects cash flows and become more resource-rich with a need to invest these resources – managers start to build an empire. Thus, more mature companies have a higher probability of overpayment in mega M&A deals compared to young and growing acquirers who are very constrained in resources due to a need for rapid expansion.

The second reason for the failure of mega deals is the integration challenge. From the corporate life cycle perspective, this reason might be interpreted twofold: managers of acquirers at later corporate life cycle stages are typically more experienced and have a stronger ability to make the integration succeed. By contrast, however, young companies should be more flexible due to lower level of organisational inertia, which can make the integration process more efficient.

Finally, the engagement in mega M&A deals is perceived as a decision to expand rapidly. The desire to expand can be treated by investors differently from the perspective of stages in the corporate life cycle. For instance, rapid

expansion for a growing company is more usual than for an introductory one, as a growing acquirer needs to deal with its competitors and create barriers for entry. Also, declining companies may provide a positive signal to investors through their engagement in mega M&A deals, which implies that the company is willing to perform drastic changes in order to survive.

Hypotheses

Based on empirical findings and the theoretical premises outlined above, we propose the following hypotheses for testing on a sample of domestic US deals over the time period 2003–2017.

H1 *In mega deals acquirers receive lower returns than in non-mega deals*

Following Alexandridis et al. (2010) and Alexandridis et al. (2013) we expect that mega deals tend to destroy value for an acquirer compared to non-mega ones [4; 5].

H2.1 *At an introduction stage, acquirers receive higher returns at the announcement of a deal, than at a growth stage.*

H2.2 *At a growth stage, acquirers receive higher returns at the announcement of a deal, than at a maturity stage.*

H2.3 *At a maturity stage, acquirers receive higher returns at the announcement of a deal, than at a decline stage.*

Hypotheses 2.1–2.3 imply that acquirers at later corporate life cycle stages achieve lower returns. Owen and Yawson (2010) and Arikan and Stulz (2016) provide evidence of the proposition that M&A performance decreases while an acquirer goes through its corporate life cycle stages [1; 2]. Investors believe that at the later corporate life cycle stages, acquirers face a greater challenge in integrating due to increasing organisational inflexibility. Moreover, at the later corporate life cycle stages, the probability of possessing huge excessive cash flows increases, which leads to inefficient investments – managers may start to build an empire without proper analysis of synergies and expected benefits, expressing overoptimism.

H3.1. *Mega M&A deals, in which acquirers are at introduction stage, have a negative impact on acquirers' returns.*

H3.2. *Non-mega M&A deals, in which acquirers are at introduction stage, have a positive impact on acquirers' returns.*

H4.1. *Mega M&A deals, in which acquirers are at growth stage, have a positive impact on acquirers' returns.*

H4.2. *Non-mega M&A deals, in which acquirers are at growth stage, have a positive impact on acquirers' returns.*

H5.1. *Mega M&A deals, in which acquirers are at maturity stage, have a negative impact on acquirers' returns.*

H5.2. *Non-mega M&A deals, in which acquirers are at maturity stage, have a positive impact on acquirers' returns.*

H6.1. *Mega M&A deals, in which acquirers are at decline stage, have a positive impact on acquirers' returns.*

H6.2. *Non-mega M&A deals, in which acquirers are at decline stage, have a positive impact on acquirers' returns.*

As has already been mentioned, engagement in a mega M&A deal is perceived as a decision to expand rapidly. The desire of an acquirer to expand rapidly at introductory stage can be perceived as too hasty and as a project for which the company does not possess enough experience. In contrast, rapid expansion for a growing company is more ordinary, at the same time young growing companies should be more flexible due to a lower level of organisational inertia [11; 12], which can make the integration process more efficient and successful. However, while an acquirer matures, it collects cash flows, becomes more resource-rich and managers start building an empire, that is the reason why more mature companies have a higher probability of overpayment in mega M&A deals and might achieve lower returns due to this fact.

Methodology

Our empirical analysis includes three steps. The first step is identification of an acquirers' corporate lifecycle stages, and differentiation between mega and non-mega deals. Based on the obtained results, the subsamples for further analysis are formed: the whole sample is divided into four subsamples based on acquirer's lifecycle stage and the question as to whether a deal is a mega or a non-mega one. The second step is the estimation of M&A performance for the full sample and determined subsamples, using a standard event study analysis. We also present a comparative analysis of M&A deals performance between stages, using t-statistics difference in means and regression analysis.

Identification of an acquirer's corporate life cycle stage

To identify LCO stages of acquiring firms, the Dickinson (2011) methodology was applied [6]. This approach assumes that all companies' important activities are captured in three different types of cash flows – operating, financing and investing. Thus, an acquirer's lifecycle stage is identified based on the signs of its cash flows at the reporting date prior to the deal announcement, in correspondence with Table 1.

Table 1. Corporate life cycle stage identification rules based on the signs of cash flows

	Introduction	Growth	Mature	Shake-Out			Decline	
Operating CF	–	+	+	–	+	+	–	–
Investing CF	–	–	–	–	+	+	+	+
Financing CF	+	+	–	–	+	–	+	–

Source: [6].

Table 2. Variables description

Variable Type	Variable Name	Description
Dependent variable	CAR	Cumulative abnormal return for a deal over event window (–1,+1)[1]
Explanatory main variable	LCS Intro	1 if an acquirer is at Introduction stage, 0 otherwise
Explanatory main variable	LCS Growth	1 if an acquirer is at Growth stage, 0 otherwise
Explanatory main variable	LCS Maturity	1 if an acquirer is at Maturity stage, 0 otherwise
Control variable	Target type	1 if a target is private, 0 otherwise
Control variable	Method of payment	1 if method of payment is total cash, 0 otherwise
Control variable	Industry relatedness	1 if a deal is a focusing one, 0 otherwise
Control variable	Acquirer's size	Natural logarithm of acquirer's assets for the last reporting date before the deal announcement moment
Control variable	Acquirer's ROA	Acquirer's net income / Acquirer's assets for the last reporting date before the deal announcement moment
Control variable	Relative deal size	Deal value / Acquirer's assets for the last reporting date before the deal announcement moment
Control variable	Financial advisor	1 if there was at least one financial advisor in a deal, 0 otherwise

Identification of a deal type – mega or non-mega deal

In most studies, mega deals are defined as those which are priced over $500 mln – $1 bln [4]. Following this approach and taking into account that the United States market is the biggest M&A market, we assume that the threshold for a mega deal is $1 bln. Thus, all deals with a value under $1 bln are treated as non-mega deals while all deals with a value equal to or higher than $1 bln are treated as mega deals.

Estimation of CARs

To assess the performance of M&A deals over different LCO stages a standard event study method is employed. The market model is used for the purpose of CARs estimation. Firstly, predicted (or "normal") returns should be estimated – for this purpose, the alpha and beta for the market model are estimated based on the data for the window (–250, –21) relative to the day of the deal announcement (day 0) in line with Craninckx and Huyghebaert (2011) [19]. Then, the estimated alpha and beta are applied to the market returns during the event window to get normal returns for the acquirer's stock. The next step is comparison of normal returns and actual returns – the difference between these returns is called "abnormal returns". Finally, abnormal returns over all days inside the event window are added together to get cumulative abnormal returns (CARs). CARs are calculated for different event windows to provide the results' robustness check: (–1, +1), (–5, +5), (–1, +5), (–10, +10), (–1, +10) in line with the work of previous researchers [20, 21, 22, 23]. Formally, the estimation steps are as follows:

Estimation of the market model:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_j, (1)$$

where α_j – intercept;

β_j – coefficient that expresses stock's volatility relative to the market return;

R_{mt} – market return at day t;

R_{jt} – acquirer's stock return at day t;

t – a day from the estimation window, j – the acquirer. The output of this estimation is $\hat{\alpha}_j$ and $\hat{\beta}_j$.

Calculation of predicted returns:

$$\hat{R}_{j\tau} = \hat{\alpha}_j + \hat{\beta}_j R_{m\tau} + \varepsilon_j, (2)$$

where $\hat{\alpha}_j$ and $\hat{\beta}_j$ – estimators from step one;

τ – a day from event window.

[1] CARs for all event windows from the previous step are used as dependent variables for the purpose of a robustness check. The regression results presented in the paper are related to (–1, +1) event windows.

Calculation of abnormal returns:

$$AR_{j\tau} = R_{j\tau} - \hat{R}_{j\tau} .(3)$$

Calculation of average abnormal returns for a day:

$$\overline{AR_{\hat{o}}} = AR_{j\hat{o}} / N_j ,(4)$$

where N_j.– number of deals (acquirers).

Calculation of cumulative abnormal returns:

$$CAR = \sum_{\tau} \overline{AR_{\tau}} .(5)$$

Then, CAR is checked for significance by means of a standard t-test.

Comparative analysis

To compare deals' performance between stages, we calculate the differences between pairs of CARs, estimated for different LCO stages, and check the significance of this difference using the t-statistics difference in means, and also employ a regression analysis, using the following model:

$$\begin{aligned} CAR_i &= \beta_0 + \beta_1 \cdot \text{LCS Intro}_i + \beta_2 \cdot \text{LCS Growth}_i + \\ &+ \beta_3 \cdot \text{LCS Maturity}_i + \beta_4 \cdot \text{Target type}_i + \\ &+ \beta_5 \cdot \text{Method of payment}_i + \beta_6 \cdot \text{Industry relatedness}_i + .(6) \\ &+ \beta_6 \cdot \text{Acquirer's size}_i + \beta_7 \cdot \text{Acquirer's ROA}_i + \\ &+ \beta_8 \cdot \text{Relative deal size}_i + \beta_9 \cdot \text{Financial advisor}_i + \varepsilon_i \end{aligned}$$

The dependent variable is cumulative abnormal return (CAR) for a single deal, which is explained by the set of independent variables, which are several dummy variables as indicators of life cycle stage and standard controls. To capture relative deals performance over appropriate stages, we introduce simultaneously three dummy variables to represent the introduction, growth and maturity stages, showing the effect relative to the decline stage, taken as a base. A description of the variables is provided in Table 2.

Sample

The sample gathered for current research consists of domestic US M&A deals. The choice of the United States market can be explained by the fact that this market represents almost a half of the global M&A market in terms of deals value as of 2017[1]. As for mega deals in particular, US mega M&As represent more than 50% of the total number of mega M&As around the world, as of 2016[2]. The focus on domestic deals arises from the fact that cross-border and domestic deals are different in their nature, as there is a separate field of M&A research that analyses these differences.

The timeframe of the deals is between 2003 and 2017, with the exclusion of the crisis period between 2008 and 2009. The crisis period is excluded as stocks' price dynamics during that period reflect crisis shocks, so it is quite difficult to eliminate these shocks in stock data to receive results which are comparable with standard non-crisis periods.

We use the Capital IQ, Bloomberg and Thomson Reuters Eikon databases to identify an initial sample of publicly traded deals that fit into the categories of complete transactions over 2003–2017. We further require that (1) a deal results in acquisition of the majority stake – at least 50% + 1, (2) both an acquirer and a target are not from the financial or utilities sectors – exclusion is based on SIC codes (6000–6999 for financial companies and 4900–4999 for utilities firms) [13], (3) an acquirer is a public company while a target might be either a public or a private one, (4) total transaction value is higher than $50 mln [24].

Our requirements yield the sample of 2,413 US domestic deals. The sample's mean deal value is $990 mln with a maximum of approximately $97 bln. The average relative deal size in the sample is approximately 28%. The average acquirer would have about $15 bln of assets and return on these assets equal to 5.5%. There are 78 deals in which an acquirer is at the introduction lifecycle stage, 763 deals with a growing acquirer, 1,345 deals with a mature acquirer, and 227 with a declining acquirer[3].

Table 3 summarises distribution over categories for category variables. Based on the data from Table 3, it can be stated that the median deal would be a friendly one where a private target from a related industry is acquired by paying otherwise than with cash.

Table 3. Number of observations distribution over category variables

Category	Number of observations
Deal attitude	
Friendly	2406
Hostile	7
Target type	
Private	2362
Public	51
Payment type	
Not total cash	2027
Total cash	386

[1] Based on the data of IMAA Institute, in 2017 the total value of US deals equaled to $1716 bln, while worldwide deal value was $3,591 bln in total. Link: imaa-institute.org.

[2] Based on the data of IMAA Institute, in 2016 the total worldwide number of mega deals equaled 590 deals. Based on the data of the statistical portal Statista, in 2016 the total number of US mega deals equaled 316. Link: imaa-institute.org, statista.com

[3] Based on the available information we were able to identify four life cycle stages (introduction, growth, maturity, decline) instead of five, as suggested by Dickinson (2011) [6].

Category	Number of observations
Industry relatedness	
Related	1261
Not related	1152

Source: authors' estimation.

Table 4 represents the distribution of the sample based on two factors – acquirer's corporate life cycle stage, and the fact of whether a deal is a mega or a non-mega one. The distribution is close to the one we would expect: the least popular life cycle stage is the introduction stage as we analyse only public acquirers and most introductory companies are not public yet. Almost 85% of the deals are non-mega deals – one might expect this share to be even higher but in our case it is affected by the initial requirement for the deal size to be $50 mln.

Results

As outlined above, the first step of analysis is an estimation of cumulative abnormal returns (CARs) over lifecycle stages. CARs for the whole sample, subsamples of mega deals and non-mega deals are presented in Table 5. As can be seen from the results, acquirers achieve positive and significant (at 1% level) returns on average, however, these returns are quite low – slightly below 1% for all event windows. While analysing mega deals and non-mega deals separately, it can be seen that investors evaluate non-mega deals better – CARs for non-mega deals are two times higher compared to the results for mega deals. The difference between CARs for mega and non-mega deals subsamples were checked for significance by t-test. Differences for all five pairs for different event windows are significant at a 5% level. Thus, Hypothesis 1 cannot be rejected at a 5% significance level. These results are in line with the previous research on mega vs. non-mega deals [4; 5].

Table 4. Distribution of the number of observations over corporate life cycle stages and mega-non-mega deals

Corporate life cycle stages	Mega deals	Non-mega deals	Total
Introduction	4	74	78
Growth	106	657	763
Maturity	247	1098	1345
Decline	29	198	227
Total	386	2027	2413

Source: authors' estimation.

Table 5. CARs for the full sample, subsamples of mega and non-mega deals for different event windows

	Full sample	Mega deals	Non-mega
(–1,+1)	0.98%***	0.57%***	1.05%***b)
	(0.00%)	(0.00%)	(0.00%)
(–5,+5)	0.96%***	0.46%**	1.06%***b)
	(0.00%)	(3.94%)	(0.00%)
(–1,+5)	0.93%***	0.46%**	1.02%***b)
	(0.00%)	(1.30%)	(0.00%)
(–10,+10)	1.00%***	0.46%	1.10%***b)
	(0.00%)	(10.05%)	(0.00%)
(–1,+10)	0.93%***	0.42%*	1.03%***b)
	(0.00%)	(6.32%)	(0.00%)
N	2413	386	2 027

***, **, * – Significance at 1%, 5%, 10% levels;

a), b), c) – Significance at 1%, 5%, 10% levels – when checking the differences between CARs for mega and non-mega deals;

N – number of observations;

p-value in parentheses.

Table 6. CARs for the full sample across lifecycle stages for different event windows

(–1,+1)	1.32%**	1.36%***	0.82%***c)	0.32%c)
	(3.08%)	(0.00%)	(0.00%)	(12.88%)
(–5,+5)	2.89%**	1.22%***	0.78%***c)	0.51%c)
	(1.61%)	(0.00%)	(0.00%)	(17.83%)
(–1,+5)	2.80%***	1.20%***	0.74%***c)	0.50%c)
	(0.47%)	(0.00%)	(0.00%)	(12.76%)
(–10,+10)	3.07%**	1.22%***	0.84%***c)	0.51%c)
	(4.95%)	(0.02%)	(0.03%)	(24.92%)
(–1,+10)	3.05%**	1.15%***	0.75%***c)	0.50%c)
	(1.54%)	(0.00%)	(0.00%)	(18.97%)
N	78	763	1 345	227

***, **, * – Significance at 1%, 5%, 10% levels;

a), b), c) – Significance at 1%, 5%, 10% levels – when checking the differences between CARs for different LCO stages;
N – number of observations;
p-value in parentheses.

Figure 1. CARs of acquirers for period (–21,+21) for all deals, mega deals and non-mega deals

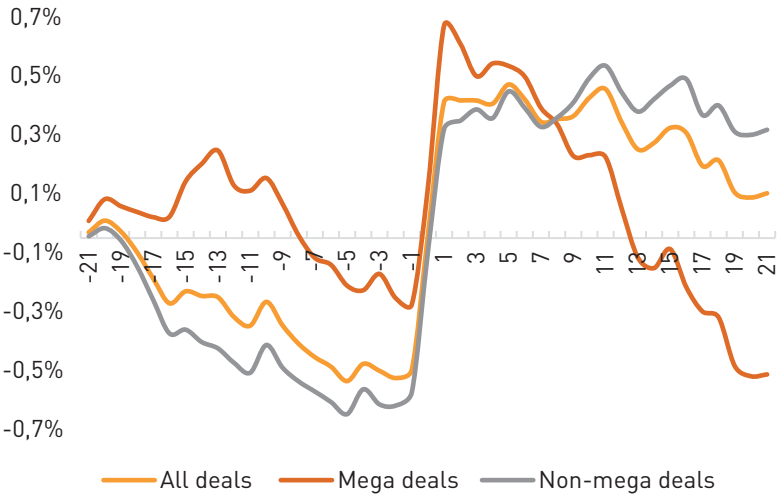

Figure 1 illustrates how CARs change over the period from 21 days before the announcement till 21 days after the announcement for all deals, and separately for mega and non-mega ones. There is an immediate jump in the moment of announcement for all deals, both mega and non-mega ones which suggests that the market had not been learning about the deals before the announcement. One more insight from the picture is that mega deals experience a much greater decline in CARs after the moment of announcement.

In Table 6 below we show CARs for the full sample across different lifecycle stages – introduction, growth, maturity and decline. From the full sample analysis we can see that CARs decrease on average over the lifecycle of an organisation, which is in line with the findings provided by Owen and Yason (2010) and Arikan and Stulz (2016) [1; 2]. At the first three lifecycle stages CARs are positive and significant at least at a 5% level of significance, while CARs that acquirers receive while being at the stage of decline are not significantly different from zero. The pairs of CARs that are compared with each other were also checked for the significance of difference between them, using the t-statistics difference in means. The results suggest that differences between CARs at growth and maturity stages and differences between CARs at maturity and decline stages are significant at a 10% level. Thus, Hypothesis 2.1 is rejected at a 10% significance level and Hypotheses 2.2 and 2.3 cannot be rejected at a 10% significance level.

Table 7. CARs for mega and non-mega deals subsample across lifecycle stages for different event windows

	Mega deals				Non-mega deals			
	Introduction	Growth	Maturity	Decline	Introduction	Growth	Maturity	Decline
(–1,+1)	–7.58%***	0.78%***b)	0.56%***	1.13%**	1.76%***b)	1.46%***b)	0.88%***b)	0.21%b)
	(0.00%)	(0.30%)	(0.02%)	(2.81%)	(0.89%)	(0.00%)	(0.00%)	(25.07%)
(–5,+5)	–11.87%***	0.88%***b)	0.45%***	1.14%**	3.62%***b)	1.28%***b)	0.86%***b)	0.42%*b)
	(0.00%)	(0.11%)	(0.18%)	(2.75%)	(0.00%)	(0.00%)	(0.00%)	(9.20%)
(–1,+5)	–11.87%***	0.94%***b)	0.44%***	1.11%**	3.53%***b)	1.24%***b)	0.80%***b)	0.41%*b)
	(0.00%)	(0.05%)	(0.24%)	(3.07%)	(0.00%)	(0.00%)	(0.00%)	(9.44%)
(–10,+10)	–11.87%***	0.87%***b)	0.45%***	1.26%**	3.81%***b)	1.28%***b)	0.93%***b)	0.41%*b)
	(0.00%)	(0.12%)	(0.21%)	(1.70%)	(0.00%)	(0.00%)	(0.00%)	(9.66%)
(–1,+10)	–11.87%***	0.85%***b)	0.40%***	1.15%**	3.78%***b)	1.20%***b)	0.83%***b)	0.41%*b)
	(0.00%)	(0.14%)	(0.54%)	(2.63%)	(0.00%)	(0.00%)	(0.00%)	(9.41%)
N	4	106	247	29	74	657	1 098	198

***, **, * – Significance at 1%, 5%, 10% levels;

a), b), c)– Significance at 1%, 5%, 10% levels – when checking the differences between CARs for different LCO stages for mega and non-mega deals; N – number of observations; p-value in parentheses.

Table 8. Regression analysis results for the subsamples of mega and non-mega deals

	Model (6) mega deals	Model (6) non-mega deals
LSC: Introduction	–0.1051***	0.0095
LSC: Growth	–0.0111	0.0123***
LSC: Mature	–0.0013	0.0092**
Target type	0.0164	0.0191*
Method of payment	0.0079	0.0014
Industry relatedness	0.0013	0.0004
Acquirer size	–0.0091***	–0.0022**
Acquirer ROA	–0.1303**	0.0324**
Relative deal size	–0.0082	0.0194***
Financial advisor	0.1087	0.0038
(Intercept)	0.1085***	0.0081
N	386	2027
R-squared	0,06	0,04
F-statistics	2,17***	8,58***

***, **, *– Significance at 1%, 5%, 10% levels;

N – number of observations.

If the full sample is divided into subsamples of mega and non-mega deals (see Table 7), we get different results for them. In mega deals, acquiring firms receives negative returns at the introduction LCO stage and positive returns at all other stages, while in non-mega deals acquiring shareholders get benefits from M&As at all LCO stages. The results also indicate that non-mega deals outperform mega ones at introduction and growth stages. It is obvious that acquirers at the introduction stage experience negative returns when being engaged in mega M&As while non-mega deals bring positive returns. This can be explained by the fact that engagement in M&A deals while being at introduction stage is perceived by investors as too aggressive and risky strategy. Thus, our hypotheses 3.1–4.2 and 5.2 are not rejected at a 1% level, hypothesis 5.1 is rejected at a 1% level, and our tested hypotheses 6.1 and 6.2 are not rejected at 5% and 10% levels correspondingly.

We further compare the performance of M&As between stages for mega and non-mega transactions separately. We capture this effect by firstly using the t-statistics difference in means to check the significance of differences between pairs of CARs at various LCO stages, and secondly, by introducing three dummy variables for the introduction, growth and mature stages, taking the decline stage as a base in model (6).Our results for mega deals (tables 7, 8) show that there is a statistically significant difference only between introduction and growth stage CARs (at 5% level) and introduction and decline stage CARs (at 1% level), indicating that acquirers at introduction stage perform relatively badly in comparison with bidders at growth and decline stages. For non-mega deals (Tables 7, 8) we find a statistically significant difference between growth and maturity stage CARs, maturity and decline stage CARs (at 5% level) and growth and decline stage CARs (at 1% level). Thus, we may conclude that the general tendency of CARs to decrease across all lifecycle stages stays in place for non-mega acquisitions.

Conclusion

This paper assesses the impact of an acquirer's corporate LCO stages on the performance of M&A deals. Our research is motivated by the increasing interest in the theory of the lifecycle of organisation (LCO), which proposes that a firm's LCO stage dramatically influences all the firm's crucial strategic decisions, among which is the decision to be engaged in M&As [25, 26]. Our review of existing empirical studies indicates that acquirers LCO stage can have a potential impact on M&A performance and its drivers. However, the literature is scarce, indicating the need for further research.

In contrast to previous studies, we analyse differences in the effect of LCO stages on M&A performance for non-mega and mega deals, which have become a popular phenomenon in last years. We also separate the acquirer's life cycle into four stages, whereas the previous studies mostly focus on three stages.

Based on a sample of 2,413 US domestic M&As deals over the years 2003–2017, and subsamples of mega (386) and non-mega (2027) deals, we find that the stock market reaction is positive for M&A deals, and this reaction is more favourable for non-mega acquisitions than for mega M&As. These outcomes do not contradict the findings of Alexandridis et al. (2010, 2013) [4; 5]. Our results also indicate that CARs decrease on average with the lifecycle of an organisation for the full sample, which supports the findings provided by Owen, Yawson (2010) and Arikan, Stulz (2016) [1; 2]. However, if the full sample is divided into subsamples of mega and non-mega deals, the general tendency of CARs to decrease across LCO stages persists only for non-mega transactions. But at all LCO stages, acquirers' shareholders will receive positive returns, while in mega M&As bidders' shareholders gain only at the growth, mature and declining stages.

Overall, our findings reveal that M&A deals affect acquirers' returns differently depending on bidder LCO stage and the type of deal, i.e. whether it is a mega or non-mega one. These results can be used as a practical guide for managers making investment decisions. They will help managers to justify a company's expansion via mega and non-mega deals, taking into account companies LCO stages.

While we obtain significant results, they are valid with regard to several limitations. First, we concern ourselves only with the developed US market. Secondly, we concentrate only on domestic M&As. Finally, this study explores short-term effects, which does not allow for the extrapolation of conclusions regarding long-term periods. Thus we suggest for further research to explore the effects of LCO stages on M&A performance for companies from other developed and emerging capital markets that are engaged in domestic and cross-border deals over short and long-term periods. We also suggest examining the impact of bidders' LCO stages in mega and non-mega deals on M&A performance for the periods before and after the global financial crisis of 2007–2008, due to enhancements in corporate governance culture in the subsequent period.

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Go for a Woman if you Feel Risky: Evidence from Gender Diversity in MFIs[I]

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Go for a Woman if you Feel Risky: Evidence from Gender Diversity in MFIs

Abstract

This paper contributes to the literature on management and corporate governance in microfinance institutions. The microfinance market is one of the rare markets with a large representation of women in management and governance roles. The objective of our paper is to reveal the effects of women's presence on the financial and social performance of microfinance institutions.

To achieve this, we develop a model that allows for capturing the influence of gender diversity in the microfinance field whilst controlling for risks. We focus on the role of women as loan officers, on boards of directors, and involved in managing the creation of microfinance institutions. Our model utilises two sets of panel data regressions, one for social performance and one for financial performance, and is tested on data from 193 microfinance institutions across Eastern Europe and Central Asia for the financial years 2010 through 2014.

The results of our investigation indicate that the activity of female members of management, CEOs, and boards of directors could increase performance indicators for riskier microfinance institutions. This is illustrated particularly in the case of projects with greater stakes in portfolios that are more than 90 days in arrears. We also provide evidence that women on boards tend more towards promoting a strategy utilising large quantities of small loans with greater interest. The social performance of microfinance institutions is crucially determined by the microfinance institutions' size. For the largest microfinance institutions, questions of social performance lie in the field of boards of directors, while smaller institutions' social performance is mostly driven by CEOs and staff, with significant evidence of a positive female influence on performance indicators.

The novelty of this study is demonstrated the scope of our research. We combine several contemporary issues of peculiar cross-disciplinary interest, and offer succinct and compelling results which will be of immediate applicability in a wide range of academic and professional fields. Our results will be of interest to scholars of gender, social studies, psychology, business, corporate structure, and more. More specifically, we add to the evolving sub-field of study of microfinance institutions, which has the potential to develop rapidly in the near future. This paper represents a cross-section of commercial and business research across a wide territory, with a large sample size, and provides compelling conclusions, which add to these fields of study by both validating existing research, and highlighting new areas for future analysis.

Key words: microfinance institutions, corporate governance, performance, gender diversity, risk

JEL classification: G30, G32, G34

Introduction

Microfinance institutions (MFIs) have been developing in emerging markets since the 1980s. They provide different kinds of financial services (loans, deposits, insurance, social intermediation and payment services) to representatives of low-income families and micro-entrepreneurs. Nowadays, microfinance institutions are of particular interest to researchers and market-watchers as they have the potential to become an innovative platform, due to mobile phone penetration, new players in the market, and massive investments in FinTech [1]. The social orientation of MFIs leads to a reduction in poverty and unemployment in the country of operation. Therefore, we will treat MFIs as not only banking entities, but also as a development tool [2]. Social activity is aimed towards providing an opportunity to vulnerable populations to live a fuller life. Introducing people to the financial services market increases the activity of citizens and leads to a certain social recovery, which contributes to removing some tensions in society.

Despite MFIs playing a significant social role, they are still commercial enterprises, i.e. they should generate profit and have a payback policy that meets investors' requirements. They should maintain a financial sustainability that allows them to continue fulfilling their social mission. Thus, MFIs should find a balance between financial and social performance. A sound policy in corporate governance helps to achieve this goal; therefore, in this paper we investigate the influence of corporate governance on the social and financial performance of MFIs in emerging markets.

Microfinance activity is to a large extent a female business [3; 4]. First of all, women represent the largest market for MFIs. Women are considered capable fighters against poverty, as they are more likely to reinvest their earnings in their families or business. Likewise, microfinance may be considered a 'woman's business' as the proportion of female directors or managers in MFIs is higher than in other financial institutions. Considering the peculiar trend of women's risk-aversion in decision-making, it is particularly crucial to investigate the effect of this female presence in the sector of MFIs, where risks are quite different from risks in other sectors. Thus, our paper focuses on gender diversity in the framework of corporate governance and management mechanisms in order to reveal the effects of women's presence on the financial and social performance of MFIs, while controlling for appropriate risk factors.

We find out that gender diversity makes a difference in the performance of MFIs with high risk portfolios. For such firms, women can increase performance and mitigate risks. We also document female influence on social performance. For larger MFIs this influence is lower and is driven by the female membership in boards of directors, while for smaller MFIs female CEOs and staff could add more to the social performance.

This paper has the following structure. In the next section, we provide a review of the existing literature. In other section we develop appropriate hypotheses and describe the methodology. The results are presented in following section. Finally, we present the discussion and our conclusions.

Literature Review

After the global financial turmoil of 2007–2008, the problem of corporate governance in financial institutions (FI) became an acutely popular field of study. It is considered that if the corporate governance of an FI is sound, it means that the FI examines the firms that it plans to fund and allocates capital efficiently [5]. When receiving money, the company invests it into the business, and expands its activity, which improves the economic development of the country. The same logic can be applied to microfinance institutions. On the contrary, if the corporate governance of an FI is at a low level, the FI faces a problem of efficiently allocating the savings of its society, with the potential for a destructive impact on the corporate governance of the firms they fund. This distress is likely to expand to the adjacent financial environment, which might in turn lead to credit restrictions with a significant effect on other industries [6]. Therefore, the corporate governance of FIs influences not only the activity of the FIs, but also non-financial companies and the economy as a whole (e.g. see [7] regarding the influence of banks on the corporate governance of loan-receiving firms).

In most countries, the government strictly regulates FI operations. This is the second reason for distinguishing the corporate governance of financial firms from that of non-financial ones. A significant quantity of FIs have to conform to international standards such as Basel I, Basel II, etc. That is why many rules change the corporate governance of financial firms and make it specific [5].

Moreover, C.H. Furfine proved that the information asymmetry is larger in FIs in comparison with firms from other industries [8]. That is especially important for our study, since in MFIs we face even higher levels of informational asymmetry than in FIs; and the asymmetry level is higher again in the emerging markets we are considering [9].

To sum up, while in this paper we focus on the role of women in the governance of MFIs', it is worth considering papers focused on corporate governance in the financial sector to realise the gap between governance in non-financial firms and financial institutions.

Corporate governance in the financial sector

As of the time of publishing, the majority of research papers focus on the relationship of corporate governance features (board size, CEO duality, board independence) and corporate performance. So, what do we know about corporate governance in FIs?

We will start with board size, since the number of directors influences both the speed of decision-making and the human capital of the board. D.R. Dalton et al. report that boards with a large number of directors increase the possibility of beneficial activity because they enhance the variety of relevant knowledge, expertise, and the resources that are available to the firm [10]. In contrast, there is another popular view that large boards are ineffective. A large size may inhibit the board from solving current

issues quickly because the board needs more time to come to a common decision. What is more, there is a possibility that free-riding problems amongst directors can appear [11]. For example, R.B. Adams and D. Ferreira analyse 5707 directorships during the years 1986–1999 and prove that board size is positively related to problems with attendance [12]. The larger the board is, the more free-riding behavior may occur.

The picture in an FI looks quite similar as concerns non-financial companies. Jensen's ideas about large, inefficient board with poor coordination and low speed of decision-making work for the FIs as well [11; 13].

Contradictory evidence (i.e. non-significant influence of board size) is provided by [14, 15]. These findings lead to the hypothesis that the relationship between board size and firm performance can be non-linear. H. Grove et al. expect that the size of the board size an impact on financial performance by means of a concave relationship [16]. They think that, initially, when the board size goes up, it might bring more expertise; however, after reaching the breaking point, the growth of the board can lead to an increase in agency conflicts and FI performance can be impaired. The researchers validate their hypothesis. However, P. De Andrés and E. Vallelado obtain contradictory results. According to their research, the efficiency of the FI decreases as the number of directors rises, and after a defined point the effect changes: the performance goes up as the number of directors declines [17].

R.B. Adams and H. Mehran analyse 35 BHCs (bank holding companies) and conclude that more members in the board correlates with an increase in the performance of the BHC, if the directors from the main board also sit on the subsidiary board [18]. The explanation of this phenomenon can be the following: being a member of the main and subsidiary board, directors comprehend the situation better at different stages of organisation and can therefore develop a plan or a strategy more appropriate for that BHC.

In emerging markers, we face more homogenous findings. Tai's research indicates that the board size positively affects the performance of national banks in the Gulf Cooperation Council (GCC) countries [19]. The same result is obtained byA.B.O.Onakoya and co-authors, based on the analysis of Nigerian banks [20].

What do we know about role of women in financial firms?

Board diversity, especially gender diversity, may influence firm performance significantly, since it is supposed that women differ from men in leadership behaviour, risk-taking, etc. S. Nielsen and M. Huse [21] emphasise that women's performance in the board depends on the tasks they are responsible for. The more female members there are in the board, the better the board's strategic control is, but there is no similar relationship with board operational control. Likewise, they obtain that the presence of women makes conflicts fade in the board, hence, there is a higher possibility of improving firm performance.

The hypothesis that the women are more risk-averse in investment decision-making is proved by [22;23]. M. Niederle and L. Vesterlund state that women are also less likely to be overconfident than men [24]. However, some investigations obtain the opposite result. For example, R.B. Adams and P. Funk demonstrate that female directors are more prone to make risky decisions [25].

At the same time, as we already mentioned, the microfinance business is to a large extent a female-dominated business [3]. Women are more likely to reinvest their earnings in their families or business, and that makes them good contributors to the social performance of financial institutions.

Finally, the fact that the proportion of female directors or managers in MFIs is higher [4] than in other sectors is worth being studied. Considering the peculiarity of women's risk-aversion in decision-making, it is important to investigate women's role in the MFI sector, where informational asymmetry (and risks) are higher than in traditional commercial FIs.

What do we know about corporate governance and the role of women in MFIs?

For MFIs, corporate governance is important not only for financial performance, but also for social performance. The board should help to find a balance between the social role and economic goals.

Corporate governance in MFIs is not a settled issue at the moment. G. Estapé-Dubreuil and C. Torreguitart-Mirada [26] investigate the difference in governance mechanisms between MFIs with diverse legal statuses (non-governmental organisations, regulated commercial financial institutions) and study the relation between governance mechanisms and the results of MFIs' missions, such as providing banking services to low-income families and micro-entrepreneurs and maintaining financial sustainability. The researchers consider not only financial performance, but also social performance. They show that corporate governance has a more profound effect on social performance than on financial performance in MFIs. They found that the instruments in the ownership-board dimension raise the enhancement of all measurements of social performance. On the contrary, governance mechanisms targeting the staff of MFIs (such as incentives and fair practices in labour) have no impact either on its social performance or on its financial performance.

R. Gohar and A. Batool investigate MFIs in Pakistan [27]. They find that the productivity of the MFI, the firm size of the MFI, individual lending, the MFI's age, and regulations, have positive significant impact on financial performance. However, the board size and CEO/chair duality have negative effects. The presence of a female director, regulation, firm size and urban market influence social performance positively, while the board size affects negatively the outreach.

Some investigators examine groups of countries which are quite similar, e.g. the activity of MFIs in East Africa is studied in N. Mori et al. [28]. The authors explore three unique characteristics of MFIs: regulation status, international influence and founder management. They find that regulated MFIs have larger boards, higher board independence and less gender diversification. The same results are obtained for internationally influenced MFIs. It is also said that MFIs managed by founders have a higher level of board gender diversity.

R. Mersland and R.Ø. Strøm also consider the influence of different factors on social performance and financial performance [29]. The results obtained reveal that financial performance improves when the board has an internal board auditor and have local rather than international directors. As regards the ownership type, it does not affect financial performance, in contrast to the work of G. Estapé-Dubreuil and C/ Torreguitart-Mirada [26]. They find that a microfinance institution is better served with a female CEO. Furthermore, social performance rises with CEO/chairman duality because the number of credit clients increases. However, the level of outreach goes down with individual loans for both average loan size and the number of credit clients.

With this study, we would like to fill in the gap in the literature investigating corporate governance in MFIs in emerging countries, with a special focus on gender diversity. We demonstrate the role of women in the financial and social performance of MFIs. Thus, to capture the effects of women's presence on risk and the performance of MFIs, we develop the following hypotheses.

*Hypothesis 1:*A female presence in the management and governance of an MFI leads to greater financial performance in emerging markets.

*Hypothesis 2:*A female presence in the management and governance of an MFI leads to greater social performance in emerging markets.

In the literature review we discussed that most researchers consider women to be more risk averse. Women are seen as more careful and might be less overconfident than men [24]. It has been demonstrated that the presence of women at different levels of management reduces firm risk and improves firm performance [30]. We expect to receive similar results. We also suppose that the influence of women is greater in MFIs which deal in riskier projects, where female risk-averseness could be more beneficial.

A positive relationship between female membership in the board and social outreach was discovered [3]. This may have happened because women think more about social outreach than men and try to help indigent people. We anticipate that the role of women on boards could be not as significant as the role of a female CEO or females in management, since the governance mechanisms in emerging markets are not developed to the same extent as in developed markets.

Methodology and data

Data

Our research is conducted on data from MFIs across Eastern Europe and Central Asia[1]. This region includes mostly emerging national economies that have similar history, development, and economy, which assists us in making the corresponding analysis and compiling the relevant results.

After refining the available data based on available information on the governance and management of MFIs, our sample was restricted to 193 microfinance institutions for 2010–2014 years.

To source our information, we used the Microfinance Information Exchange (MIX), and the information from the official websites of different MFIs to collect data. MIX provides reliable data because its specialists collect data from financial statements, and follows the International Financial Reporting Standards (IFRS), including management reports and other documents which contain relevant information. Furthermore, the data from MFIs is monitored constantly.

Description of variables and methodology

Our study assumes two steps, and hence two major sets of regressions to be tested. The first step refers to the impact of a female presence in corporate governance and management on financial performance (1), and the second set measures the influence of women on social performance (2):

$$\begin{aligned}\text{Financial proxy}_{it} &= \beta_1 + \beta_2 \text{lev}_{it} + \\ &+ \beta_3 \text{par90}_{it} + \beta_4 \text{wceo}_{it} + \\ &+ \beta_5 \text{wboad\_pc}_{it} + \beta_6 \text{wman\_pc}_{it} + \\ &+ \beta_6 \text{wstaff\_pc}_{it} + \beta_8 \text{board\_size}_{it} + \\ &+ \beta_9 \text{firm\_size}_{it} + \beta_{10} \text{opex\_loan}_{it} + \\ &+ \beta_{11} \text{operating\_ortfo}_{it} + \beta_{12} \text{age}_{it} + \\ &+ \beta_{13} \text{GDP\_PPP}_{it} + \beta_{14} \text{interraction}_{it} + \varepsilon_{it}\end{aligned} \quad (1)$$

$$\begin{aligned}\text{Social\_proxy}_{it} &= \alpha_1 + \alpha_2 \text{offices}_{it} + \\ &+ \alpha_3 \text{par90}_{it-1} + \alpha_4 \text{wceo}_{it} + \\ &+ \alpha_5 \text{wboard\_pc}_{it} + \alpha_6 \text{wman\_pc}_{it} + \\ &+ \alpha_7 \text{wstaff\_pc}_{it} + \alpha_8 \text{board\_size}_{it} + \\ &+ \alpha_9 \text{firm\_size}_{it} + \alpha_{10} \text{interraction}_{it_{it}} + \\ &+ \alpha_{11} \text{operating\_ortfo}_{it} + \alpha_{12} \text{age}_{it} + \\ &+ \alpha_{13} \text{GDP\_PPP}_{it} + \mu_{it}\end{aligned} \quad (2)$$

A detailed description of the variables and the descriptive statistics may be found in Appendix 1 (see Tables 1 and 2).

[1] See: https://www.themix.org/mixmarket/countries-regions/eastern-europe-and-central-asia

Dependent variables are divided into 2 groups depending on the type of regression.

The first group of regressions deals with the financial performance of MFIs measured as return on assets, return on equity, operational self-sufficiency, profit margin, and portfolio yield [29; 27].

The second group considers the social performance of MFIs, which should be measured in a way to reflect six aspects of social outreach of microfinance activity: worth to clients, cost to clients, depth, breadth, length, and scope [31]. In our research, we measure performance by two of these measures: depth and breadth.

The depth of outreach is defined as the estimated value of a net gain of a particular client. The indirect proxies are used more often than the direct indicators of depth through income or wealth because of the difficulty of accurately gauging the measurement. That is why researchers prefer to use, as indicators, sex, location, ethnicity, housing, and access to public services. However, the most common proxy for depth is loan size. The best way to measure this is to use the average amount outstanding. If the loan size is small, it means that the depth is great, because there is a greater possibility that the person is poor.

The next aspect is the breadth of outreach. This is measured by the number of clients. We also investigate the growth in the number of borrowers separately.

Additionally, the investigators tend to use one more proxy for defining social performance – the percentage of female borrowers. This indicator is used because it has been proven that females are almost three times more likely to reinvest their earnings in the business and in their families than men are [32].

We focus particularly on the interrelation of women's influence in cases of high or low risks. Our measure of risk is 'portfolio at risk > 90 days ratio'. The portfolio at risk > 90 days ratio is the proportion of overdue loans (overdue by more than 90 days) in the loan portfolio. This coefficient demonstrates that a rise in overdue credit leads to an increase in the possibility of the failure to pay back the loan, increasing the risk to the MFI. To capture the influence of women in the presence of risks, we add interactive terms to basic regressions. As interaction variables, we include the interactions between the risk measure *par90* and the percentage of women in management, or the presence of female CEOs.

Control variables include operating expense-to-loan portfolio ratio, leverage, the number of offices, the firm size, the age, and GDP per capita.

The correlation matrix is presented in Appendix 2, Table 3.

Results

Our final results are presented in Tables 4–7, and 8 of Appendices 3 and 4.

We start with the results of the financial performance of MFIs with regard to gender diversity (Tables 4 and 5).

We measured performance with profit margin, ROA, ROE, nominal yield on gross portfolio and operational self-sufficiency. Our results show that MFIs with a greater fraction of the portfolio with more than 90 days in arrears tend to have poorer performance. Although that result could be regarded as self-evident, as regards profit margin and ROA we can see that despite the risk, the percentage of women in management (2) increases performance. The same is true for the cases of female CEO presence, provided the risks are greater than average (the average value of *par90* is 0.048 in our sample). This result is especially strong for small MFIs (3).

We also discovered the positive influence of women on boards on measures of performance, calculated as ROA, ROE, and yield on gross portfolio- i.e. the measures that are highly dependent on MFI strategy. This influence is correlated with the greatest for yield in gross terms *vis-à-vis* the MFI portfolio. To prove that point, we looked closer at the relationship between the gender diversity in boards and MFIs strategies. As could be seen in Table 6, where we measured the characteristics of loans in MFIs with the highest and lowest quartile of women with a stake in boards in directors, MFIs with more women on board try to promote the strategy of more small loans with greater interest, while for MFIs with lower gender diversity we see larger loans with lower interest rates. As a result, the yield in terms of the overall (gross) portfolio is greater in MFIs with more women on boards.

The yield on gross portfolio is the only measure influenced by the macroeconomic conditions measured by GDP per capita, which is reasonable, since the interest on loan portfolio is highly dependent on the macroeconomic situation in a country. For the remaining measures the internal methods of management and governance matter more(Table 6).

We found at first glance a controversial result for operating self-sufficiency, where the presence of a male CEO is seen to improve performance (when calculating the influence of male CEO interaction with risk measures). Although this could be regarded as evidence that female CEOs care more about profit margins while male CEO care more about cost efficiency, we suppose that this could most likely be a result of company size. As the MFI becomes larger, it moves from the strategy of increasing margin to increasing cost efficiency as well. We checked this idea by measuring the effect separately for small companies (12) in order see if we lose the significance of CEO gender on operating self-sufficiency. The idea of the effect is as follows: the greater the size of the MFI, the more probability there will be a male CEO. The same, however, is not true for margin measures (3) where women CEOs could mitigate the risks effects on profit margin.

Finally, we found a strong negative influence of leverage on financial performance for all measures except ROE and yield on gross portfolio. We believe that this result is reasonable, since leverage decreases the overall solvency of MFI, which leads to lower efficiency. On the other hand, by means of leverage, MFIs could increase the return to

shareholders (ROE) though increasing risks. The yield on gross portfolio is mostly determined by macro conditions, and hence this performance measure is not that influenced by leverage.

In summing up, we could state that the presence of women in management roles of MFIs and in governance roles could be especially profitable for MFIs in the high risks category, where women are seen to propose and implement more secure strategies.

Next, we present the results of our evaluation of female presence on social performance (Tables 7 and 8, Appendix 4).

We start with the average loan measure, and find a contradictory result to our previous findings. In this case, a greater stake of female managers leads to larger volume of average loans (1). To separate this result from the size effect, we separately examined firms of lower than average size (2), and a subsample of 25% of the largest companies (3). We found that women's presence can lead to a greater-than-average loan, but only in largest MFIs. On average, in these MFIs you may expect to see a male CEO, and management who care more about cost efficiency. For these MFIs, women could affect a change by increasing the size of the average loan. Still, we could state that to have deeper results, it may be prudent to look at the average loan amount per borrower. As we can see at (4), the gender diversity in management or governance does not influence the average loan per borrower. On the other hand, we can see the influence of firm size, firm age, and GDP per capita, as well as the number of offices. Supposing that the size effect here could also necessitate different models for gauging social performance, we distinguished the results for 50% of the largest (4) and smallest (5) companies by median size. We found out that for the largest firms, social performance is considered at board level, where women on board tend to lower the high levels of average loans. For smaller firms, we see that the influence of a CEO is greater, and a female CEO (not a manager of the board) tends to increase the size of small average loans. Thus, the social performance is mostly determined by CEO in small MFIs, whereas in larger MFIs it is determined by decisions of the board.

The number of borrowers (7) is often considered to be the fundamental measure of social performance. Still, it is again highly dependent on the firm size: for the largest MFIs we usually see a male CEO and a greater number of borrowers. Thus, we propose the measure of growth in the number of borrowers as a more representative value. We found out that if we look at the subsample of small and medium firms (9), a female CEO increases the growth in borrowers' numbers, whereas for 25% of the largest MFIs this is not the aim of the strategy, and so we see a relatively low quality in the regression on the whole sample (8). Still, we see that for all subsamples the number of offices matter, which is rational, since this would increase the probability of new customers for the MFI. Finally, we got the result, that the percentage of female borrowers could be greater in MFIs with more female staff and more women on board (10). We see also that younger MFIs tend to have more female borrowers, however, this could be a result of male borrowers' choice to patronise older and more renowned MFIs.

Conclusion

This paper provides results of our research into MFIs' corporate governance and the influence of management on financial and social performance in Eastern Europe and Central Asia. We pay particular attention to the presence of women in management and governance roles in MFIs in order to show that the notably high presence of women in this industry is reasonable. We conduct am empirical analysis on the data from 193 MFIs over the period 2010 to 2014, as provided by the MIX database.

Our results provide insights into the influence of females in the financial and social performance of MFIs in Central Europe and Eastern Asia. We found out that women could be especially efficient in MFIs with higher levels of risk. In such MFIs female CEOs increase the quality of performance under various commercially significant categories. Female influence is also beneficial in small MFIs. For large and solvent MFIs the influence of women's presence is not as significant. We also show that women in boards tend to mitigate risks and tend towards developing a strategy of a large volume of small loans, which is also an indicator of social performance and engagement.

The results on social performance are highly influenced by the size effect. Still, we may conclude that the female role is crucial in staff and CEO positions for smaller MFIs, and in board positions for larger ones.

Overall, our results coincide with the suggestions of previous researchers that women are more risk averse, and thus we show that their presence is highly important for MFIs with a high level of risky commercial engagements, or for small MFIs where governance mechanisms are not so strong.

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Appendix

Appendix1

Table 1. The description of variables

Variable	Name	Method of calculation
Return on assets measured	ROA	Net operating income less taxes/average assets
Return on equity	ROE	Net operating income less taxes/average equity
Operational self- sufficiency	OSS	Financial revenue/ (Financial expense + impairment loss + operating expense)
Profit margin	Pmargin	Net operating income/Financial revenue
Yield on gross portfolio	Yield	Interest and fees on loan portfolio/gross average loan portfolio
Average loan balance	Avloan	Gross loan portfolio/number of portfolios in MFI
Average loan balance per borrower	Avloanborr	Gross loan portfolio/number of current borrowers
Number of borrowers	Nborr	Number of current borrowers; individuals who have multiple loans with an MFI are counted as a single borrower
Percentage of women-borrowers	wborr_pc	Number of current borrowers who are women/Number of current borrowers
Size of board of directors	board_size	Number of directors in the board
Percentage of women in board of directors	wboard_pc	Number of women in board of directors/size of the board of directors
Female CEO	Wceo	A dummy indicating a female when equal to 1
Percentage of women in the management	wman_pc	Number of women in the management/Total number of managers
Portfolio at risk > 90 days ratio	par90	The fraction of the portfolio with more than 90 days in arrears; Portfolio at risk>90 days/Loan portfolio, gross
Operating expense to loan portfolio ratio	opex_loan	Operating expense/loan portfolio, gross, average
Offices		The number of staffed points of service and administrative sites used to deliver or support the delivery of financial services to microfinance clients
Age of the MFI	Age	The number of years of MFI since establishment
Firm size	firm_size	Ln(assets)
GDP per capita based on purchasing power parity	GDP_PPP	GDP per capita based on purchasing power parity
Leverage	Lev	Liabilities to assets ratio of MFI

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	839	0.047236	0.096814	–0.3112	0.602149
OSS	836	1.319406	0.665016	0.3969	8.3036
Pmargin	823	0.150578	0.263138	–1.5198	1
yieldnom	805	0.313878	0.279051	0.0001	3.2055
par90	816	0.047797	0.081828	0	0.738743
Avloan	836	4.654328	7.527864	0.101474	82.43048
wborr_pc	839	0.445017	0.203232	0.0041	1
Nborr	839	17605.64	36261.2	3	357072
opex_loan	800	0.194445	0.176598	0.0001	1.5864
GDP_PPP	996	12.09109	6.966864	2.08	25.261
board_size	839	4.052443	1.734011	0	10
wboard_pc	839	0.315433	0.236291	0	1
wceo	836	0.399522	0.490093	0	1
wman_pc	839	0.500248	0.271358	0	1
wofficer_pc	839	0.48586	0.286124	0.0052	1
offices	839	24.03456	55.11106	0	536
age	839	10.60191	5.429856	0	29
firm_size	839	16.30523	2.230847	8.844192	21.79851

Appendix 2

Table 3. Correlation matrix

	OSS	lev	par90	wceo	wman_~90	par90_~o	wboard~c	wman_pc	wstaff~c	board_~e	firm_s~e	opex_l~t	age	GDP_PPP
OSS	1													
Lev	–0.3321	1												
par90	–0.0842	–0.0333	1											
Wceo	0.0135	–0.0542	–0.1084	1										
wman_par90	0.0109	–0.0781	0.8684	–0.0586	1									
par90_wceo	–0.0031	–0.0387	0.3133	0.5105	0.2988	1								
wboard_pc	0.0304	–0.0637	–0.0485	0.0917	–0.0125	–0.0096	1							
wman_pc	0.1229	–0.2221	0.062	0.1289	0.3463	0.1166	0.2163	1						
wstaff_pc	0.0355	–0.04	0.1162	0.1157	0.2048	0.091	0.3103	0.4554	1					
board_size	–0.1232	0.131	–0.0167	0.0797	–0.0365	0.0362	0.1323	–0.0326	0.1313	1				
firm_size	–0.2377	0.5019	0.0854	–0.2002	–0.0419	–0.095	–0.065	–0.3254	–0.0171	0.3127	1			
opex_loanp~t	–0.0118	–0.1413	–0.1229	–0.0432	–0.1066	–0.0883	0.0743	0.0811	–0.0299	–0.1369	–0.299	1		
age	–0.1736	0.1697	0.0644	0.0518	0.0351	0.1247	–0.0663	–0.0662	0.0222	0.3061	0.3984	–0.1941	1	
GDP_PPP	0.065	–0.1202	0.1289	0.18	0.1976	0.1662	0.025	0.2747	0.3575	–0.0513	–0.0268	–0.0825	0.0546	1

Appendix 3

Table 4. The influence of female presence on financial performance measured as profit margin, ROA and ROE

	(1)	(2)	(3)•	(4)	(5)	(6)	(7)
VARIABLES	pmargin	pmargin	Pmargin	ROA	ROA	ROE	ROE
lev	−0.334***	−0.342***	−0.306***	−0.0572***	−0.0608***	0.118**	0.106*
	(0.0479)	(0.0479)	(0.0616)	(0.0148)	(0.0148)	(0.0585)	(0.0590)
par90	−1.274***	−2.045***	−1.765***	−0.209***	−0.465***	−0.294	−0.942**
	(0.171)	(0.314)	(0.265)	(0.0532)	(0.0987)	(0.219)	(0.436)
wceo	−0.0361	0.00537	−0.0743	−0.0118	−0.00591	0.0365	0.0117
	(0.0342)	(0.0309)	(0.0472)	(0.0104)	(0.00934)	(0.0383)	(0.0337)
par90_wceo	0.865**		1.880***	0.108		−0.686	
	(0.350)		(0.519)	(0.110)		(0.482)	
wboard_pc	0.0480	0.0539	0.0427	0.0255*	0.0273*	0.118*	0.125**
	(0.0468)	(0.0466)	(0.0649)	(0.0146)	(0.0146)	(0.0609)	(0.0612)
wman_pc	0.0625	−0.0201	0.109*	−0.00659	−0.0296*	−0.0872	−0.129*
	(0.0467)	(0.0514)	(0.0654)	(0.0146)	(0.0161)	(0.0601)	(0.0688)
wstaff_pc	−0.0786	−0.0870	-0.0732	−0.00553	−0.00613	0.0979	0.107
	(0.0758)	(0.0755)	(0.100)	(0.0236)	(0.0234)	(0.0944)	(0.0949)
board_size	−0.00365	−0.00386	-0.0107	0.00104	0.00100	0.00361	0.00356
	(0.00844)	(0.00842)	(0.0129)	(0.00258)	(0.00257)	(0.00950)	(0.00957)
firm_size	0.0215**	0.0246***	0.0190	−0.00664**	−0.00574**	−0.0262***	−0.0243**
	(0.00896)	(0.00899)	(0.0157)	(0.00273)	(0.00273)	(0.00997)	(0.0101)
opex_loanport	−0.161***	−0.141**	−0.256***	−0.0120	−0.00704	−0.0309	−0.0247
	(0.0586)	(0.0584)	(0.0811)	(0.0184)	(0.0183)	(0.0774)	(0.0779)
age	−0.00241	−0.00234	−0.00810*	−8.53e-05	−7.76e-05	0.00404	0.00375
	(0.00289)	(0.00288)	(0.00427)	(0.000878)	(0.000874)	(0.00317)	(0.00319)
GDP_PPP	−0.000287	−0.000121	−0.000700	−0.00120	−0.00118	−0.00232	−0.00251
	(0.00244)	(0.00243)	(0.00364)	(0.000731)	(0.000728)	(0.00253)	(0.00255)
wman_par90		1.770***			0.517***		0.986
		(0.505)			(0.160)		(0.746)
Constant	0.128	0.108	0.245	0.209***	0.205***	0.424***	0.426***
	(0.138)	(0.138)	(0.232)	(0.0420)	(0.0418)	(0.154)	(0.155)

• The specification presents the results for firms with lower than average firm size.

	(1)	(2)	(3)*	(4)	(5)	(6)	(7)
VARIABLES	pmargin	pmargin	Pmargin	ROA	ROA	ROE	ROE
Number of id	183		124	183	183	183	183
Wald chi2	110.23	117.22	84.22	62.59	72.66	24.4	23.84
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0214

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

Table 5. Influence of female presence on financial performance measured as nominal yield on gross portfolio and operating self-sufficiency

	(8)	(9)	(10)	(11)	(12)*
VARIABLES	yieldnom	yieldnom	OSS	OSS	OSS
Lev	0.0178	0.0179	-0.529***	-0.567***	-0.506***
	(0.0454)	(0.0458)	(0.107)	(0.107)	(0.143)
par90	-0.324	-0.241	-1.097***	-2.799***	-1.323**
	(0.203)	(0.338)	(0.380)	(0.698)	(0.624)
Wceo	-0.0220	-0.00961	-0.0796	-0.133*	-0.0980
	(0.0304)	(0.0266)	(0.0766)	(0.0690)	(0.109)
par90_wceo	0.309		-1.493*		-1.569
	(0.374)		(0.776)		(1.222)
wboard_pc	0.0777*	0.0767*	-0.144	-0.134	-0.205
	(0.0460)	(0.0461)	(0.104)	(0.104)	(0.152)
wman_pc	-0.00156	-0.00312	0.153	0.0553	0.280*
	(0.0455)	(0.0514)	(0.104)	(0.114)	(0.153)
wstaff_pc	0.0216	0.0202	0.108	0.123	0.156
	(0.0722)	(0.0724)	(0.169)	(0.168)	(0.233)
board_size	-0.00603	-0.00601	-0.0161	-0.0163	-0.0453
	(0.00744)	(0.00748)	(0.0189)	(0.0188)	(0.0297)
firm_size	-0.00950	-0.00962	-0.00290	0.00204	-0.0179
	(0.00785)	(0.00792)	(0.0201)	(0.0201)	(0.0363)
opex_loanport	0.698***	0.699***	-0.347***	-0.339***	-0.468**
	(0.0582)	(0.0585)	(0.130)	(0.130)	(0.189)
Age	-0.00513**	-0.00500**	-0.0155**	-0.0156**	-0.0263***
	(0.00250)	(0.00251)	(0.00647)	(0.00643)	(0.00982)

* The specification presents the results for firms with lower than average firm size.

GDP_PPP	-0.00394*	-0.00397*	0.00309	0.00266	0.00344
	(0.00204)	(0.00205)	(0.00548)	(0.00544)	(0.00834)
wman_par90		0.00755		2.494**	
		(0.542)		(1.122)	
Constant	0.432***	0.431***	1.962***	1.968***	2.339***
	(0.121)	(0.121)	(0.309)	(0.307)	(0.538)
Observations	766	766	768	768	470
Number of id	182	182	183	183	124
Wald chi2	221.14	218.31	80.41	82.04	54.56
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

Table 6. The summary statistics on loans qualities, dependent on gender diversity in boards in directors.

Variable	Obs	Mean	Std. Dev.	Min	Max
Where the percentage of women in boards of directors is more than 40%					
number_loans	167	23726.72	54801.45	47	357072
average_loan per borrower	167	0.836196	0.904536	0.0105	4.5578
avloan	167	2.707704	3.459931	0.131615	17.6118
number_ borrowers	167	22.79678	53.28309	0.047	357.072
Where the percentage of women in boards of directors is less than 16.6%					
number_loans	203	16914.01	40377.03	10	252194
average_loan per borrower	202	0.997211	1.097821	0.068	6.5525
avloan	203	4.541215	6.715681	0.101474	44.94717
number_borrowers	203	14.49351	33.82759	0.005	180.207

Appendix 4

Table 7. Influence of female presence on social performance measured as average loan size, average loan per borrower

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	avloan	avloan	avloan	avloanborr	avloanborr	avloanborr
Wceo	-0.454	0.214	-0.642	0.0538	-0.195	0.192*
	(0.561)	(0.553)	(1.772)	(0.0932)	(0.156)	(0.115)
wboard_pc	-0.299	-0.210	-0.103	-0.146	-0.413**	0.161
	(0.754)	(0.765)	(2.057)	(0.122)	(0.185)	(0.161)
wman_pc	1.745***	0.977	3.709**	0.0318	0.143	-0.0650
	(0.659)	(0.672)	(1.814)	(0.108)	(0.158)	(0.147)
wstaff_pc	0.337	-0.448	10.97**	0.0174	-0.00808	-0.227
	(1.221)	(1.157)	(4.940)	(0.201)	(0.384)	(0.247)
board_size	0.169	-0.0796	0.485	-0.00969	0.00323	-0.0190
	(0.147)	(0.161)	(0.325)	(0.0239)	(0.0313)	(0.0341)
firm_size	0.572***	0.159	2.305***	0.211***	0.431***	0.237***
	(0.179)	(0.194)	(0.771)	(0.0292)	(0.0610)	(0.0446)
opex_loanport	-1.762**					
	(0.867)					
Age	-0.0606	-0.0759	0.0284	-0.0220**	-0.0395***	-0.0232*
	(0.0591)	(0.0610)	(0.144)	(0.00984)	(0.0140)	(0.0138)
GDP_PPP	0.190***	0.266***	-0.0387	-0.0302***	-0.0501***	-0.0249**
	(0.0554)	(0.0565)	(0.138)	(0.00914)	(0.0133)	(0.0121)
L.par90	7.121***	5.562**	8.576	0.146	0.719	-0.902*
	(2.496)	(2.379)	(6.772)	(0.414)	(0.662)	(0.538)
Offices	-0.00783	-0.0239	-0.0156*	-0.00207**	-0.00261**	-0.00378
	(0.00614)	(0.0146)	(0.00838)	(0.00102)	(0.00108)	(0.00429)
Constant	-7.654***	-1.236	-45.86***	-1.786***	-5.351***	-1.976***
	(2.946)	(3.045)	(13.84)	(0.476)	(1.050)	(0.667)
Observations	586	448	161	606	321	274
Number of id	184	149	52	192	100	103
Wald chi2	52.96	39	33.9	72.82	83.63	41.52
Prob > chi2	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

Table 8. Influence of female presence on social performance measured as number of borrowers, growth in number of borrowers and percentage of female borrowers

	(7)	(8)	(9)	(10)
VARIABLES	nborr	grnborr	grnborr	wborr_pc
wceo	-8.209***	-0.145	0.344**	0.0191
	(2.740)	(0.795)	(0.155)	(0.0218)
wboard_pc	-2.477	-3.082*	-0.213	0.0637**
	(3.880)	(1.661)	(0.314)	(0.0313)
wman_pc	-5.588	-0.250	0.223	-0.0361
	(3.477)	(1.669)	(0.327)	(0.0281)
wstaff_pc	6.580	1.257	-0.350	0.188***
	(6.281)	(2.504)	(0.458)	(0.0505)
board_size	0.644	0.402*	-0.00118	-0.00465
	(0.718)	(0.236)	(0.0476)	(0.00573)
firm_size	5.263***	0.0658	0.0738	-0.00281
	(0.823)	(0.229)	(0.0580)	(0.00649)
opex_loanport				
age	1.049***	-0.112	-0.0440***	-0.00488**
	(0.280)	(0.0780)	(0.0155)	(0.00221)
GDP_PPP	0.0244	0.00635	-0.0280**	-0.00349*
	(0.239)	(0.0599)	(0.0121)	(0.00187)
L.par90	-19.59	14.13***	1.869*	0.112
	(12.21)	(4.829)	(1.052)	(0.0978)
offices	0.285***	-0.000317	0.00193	0.000372*
	(0.0286)	(0.00725)	(0.00670)	(0.000225)
Constant	-84.35***	-0.746	-0.123	0.486***
	(13.38)	(3.802)	(0.916)	(0.106)
Observations	609	609	446	609
Number of id	193	193	149	193
Wald chi2	350.37	16.45	20.98	36.98
Prob > chi2	0.0000	0.0874	0.0213	0.0001

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1.

The Impact of the Digital Transformation of Business on Corporate Governance. An Overview of Recent Studies

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The Impact of the Digital Transformation of Business on Corporate Governance. An Overview of Recent Studies

Abstract

This article presents a survey of recent studies on the impact of digitalisation, and particularly blockchain technology, on corporate governance and the principal-agent conflict in companies. The principal-agent conflict has been a centerpiece of the corporate governance research for more than 40 years. However, recent technological developments, and blockchain in particular, has created new avenues for exploration.

We survey the implications of blockchain for the principal-agent conflict in three parts: 1) the organisational environment, and the creation of the conflict; 2) common observable instances of conflict; 3) actions necessary to maximise the value of blockchain implementation. We limit the studied conflict to the relationship between shareholders and management. We also limit the blockchain use cases to those currently in testing. The applications for blockchain in securities trading and for corporate functions automation via 'smart' contracts are both analysed. We also evaluate the implications for investor activism.

Our results indicate that passive investor behaviour is at the core of the environment that creates conflict. One of the key drivers of low activity is a non-transparent voting process resulting in low participation rates. Studies indicate that blockchain can solve this issue, thus mitigating the conflict, and is an attractive proposition for board members. The most frequent instances of conflict are related to the composition of boards of directors and compensation schemes observed at shareholder voting. Using blockchain for settlement would eliminate ambiguity in shareholder registers and prevent such strategies as "empty voting". Smart contracts promise automation of governance functions like audit, which also weakens conflict. Even skeptics agree that voting is a promising application for blockchain. However, there is evidence that blockchain poses its own problems, and that smart contracts are associated with practical risks. Some critics argue that blockchain is less efficient than conventional corporate procedures.

Blockchain is among the top digital technologies that business leaders have to monitor closely. As such, this overview of the most up-to-date thinking on the subject is relevant for anyone interested in the future of corporate governance and the digitalisation of business processes. This evaluation serves to highlight the current status of this innovative resource, outlining for both professionals and newcomers what exactly blockchain's potential uses and implications are, while also outlining where a lack of quantitative research creates opportunities for further contributions to the research field. This study will also be instructive for those investigating blockchain implementation and the optimal characteristics of the solution.

Key words: corporate governance, blockchain, digital transformation, board of directors, corporate voting, proxy contest

JEL classification: G32, G34

Introduction

Since the publicationarticle of M. Jensen and W. Meckling (1976) [1], and the earlier work by A. Berle and G. Means [2], the principal-agent conflict has been a mainstream framework of corporate governance research. Managers and shareholders have diverse objectives. This sometimes leads to situations where management makes suboptimal decisions for the shareholders, and even for the management itself, in the long run (e.g. by investing less in innovation [3]). This situation results in conflicting shareholder proposals for annual shareholder meetings [4], and proxy contests and other forms of activism [5; 6]. While the topic of the principal-agent conflict is as relevant as ever, recent technological developments have served to increase its significance.

We appreciate the fact that principal-agent conflict is not just between shareholders and management, as it includes bondholders [7] and other stakeholders [8]. However, for the purpose of this article, we limit the conflict to the interaction between shareholders and management, since it is the most well-researched area.

Blockchain is a technology that arguably presents the most transformative potential of any other [9–11]. According to M. Swan [12], "…(the) blockchain concept… is a new organising paradigm for the discovery, valuation, and transfer of all quanta (discrete units) of anything, and potentially for the coordination of all human activity at a much larger scale than has been possible before".

Blockchain has the potential to change fundamentally alter the value creation and distribution mechanisms within a firm, which in turn affects the principal-agent conflict. We cluster the potential impact of blockchain on the conflict into three categories: 1) the organisational environment, and the creation of the conflict; 2) common observable instances of conflict; and 3) actions necessary to maximise the value of blockchain implementation. Understanding these changes has important practical consequences. It will help both shareholders and managers embrace the opportunities offered by blockchain, define approaches in order to help manage risks, and ultimately develop strategies for sustainable cash flow generation.

The technology and business community has embraced the opportunities offered by blockchain, and the scholarly discussion has been gaining momentum as well, especially in computer science literature [e.g. 13; 14]. The most well-researched blockchain-related topic in the field of corporate finance so far has been cryptocurrencies such as Bitcoin [e.g. 15–17]. The cryptocurrencies research has led to further development in other fields. M. Holub and J. Johnson [18], conduct a systematic review of Bitcoin's influence and expansion on academic research fields. Fundamental shifts in value creation and distribution mechanisms start to get attention as well. In this article, we review the existing studies on blockchain and corporate governance and identify key blank spots for potential new research.

The rest of this article is structured as follows: we briefly review the blockchain technology and its application;we review the literature according to the three categories of impact of blockchain on corporate governance mentioned above, andwe provide conclusions and identify the most promising areas for future research.

Brief overview of blockchain technology

There are multiple detailed articles describing blockchain technology in different levels of detail for readers of various levels of expertise. For example, a book by M. Swan [12] or an article by D. Yermak [9] for a review of the technology and its main concepts and applications, or an article by F. Hawlitschek et al. [19] for a more technical overview coupled with a technical literature review. However, we believe it is important to outline the key concepts in this article.

According to F. Hawlitschek et al., "A blockchain is a database shared among its users that allows them to transact valuable assets in a public and pseudonymous setup without the reliance on an intermediary or central authority… From a technical perspective, a blockchain is a composition of a distributed database, a decentralised consensus mechanism, and cryptographic algorithms. More specifically, transactional data is stored in a potentially infinite sequence of cryptographically interconnected data blocks. These blocks are ordered by a decentralised time stamping algorithm, which allows users to vote on the validity of database updates and eventually agree on the correct order of transactions and a shared system state at any given point in time. As a result, the users of a blockchain system can interact without the need for a central authority that resolves conflicting views of the correct order of transactions" [19].

Broadly speaking, research literature covers two types of blockchain application that affect the principal-agent conflict: a reliable distributed ledger coupled with a platform for transactions, and smart contracts. We will briefly describe both.

A reliable ledger

As per V. Magnier and P. Barban in their 2018 composition, "by itself, the blockchain is a public register… As there is no third party or central authority overseeing the system, the public itself must be able to access all the transactions occurring on a blockchain…. Each blockchain can…be downloaded by all users, containing all the past transactions since its creation… In order to manipulate the register, it would be necessary to change all the past history of the register on a global scale: each and every version of the blockchain on all existing and active nodes would have to be similarly impaired. Such a manipulation would need an overwhelming computing power…" [20]. This blockchain application helps the creation of basic cryptocurrencies such as Bitcoin. From the corporate governance point of view, the main consequence

of this application is full transparency on the recorded transactions. We will discuss the concrete implications in the next sections of the article.

Smart Contracts

Smart contracts are obligations stored in computer code that execute themselves without control of third parties [12; 21]. While smart contracts were envisioned as early as 1990s [10; 22; 23], the first real world applications were created only with the creation of blockchain.

Smart contracts are the blockchain application with strong enough potential to challenge the nature of the principal-agent conflict. Smart contracts can reduce the power of management and create transparency for shareholders [24; 25]. Various researchers have suggested application areas for smart contracts for financial markets [26; 27], in trade finance [10], for supply chain management [28], government services [29], and the energy sector [30]. Experiments have been conducted around creating entire organisations without management (so called DAOs) [31; 32]. We will review these experiments later in the article.

As one may imagine, the two blockchain applications mentioned above have different implications for the principal-agent conflict. While using blockchain purely as a ledger is very pragmatic and may generate positive impact in the near future, the use of smart contracts has a much bigger potential, but will most likely take more time to unfold. In the next sections of the article we will review the implication of both types of blockchain applications.

The organisational environment, creating the conflict

The conflict between shareholders and managers arises when the management team and, most notably, the CEO gains disproportionate power in the organisation, allowing it to overpower the board of directors [33–35].

At the core of the environment which makes the conflict possible, is passive investor behavior [36]. According to a study by Broadridge Financial Services, which tabulates votes in most U.S. corporate elections, voter turnout rates of 83% are reported for institutional investors but only 28% for household retail investors[1]. Studies show that investors do not actively monitor portfolio firms [37; 38] or blindly follow recommendations of proxy-voting advisors such as ISS [39; 40]. This is more relevant in the case of homogeneity among the shareholders [41; 42]. The growth of "index funds" increases the issue even further [38].

A non-transparent voting process that is often influenced by management is one of the primary reasons for a low shareholders voting turnout. Examples of problems with voting include inexact voter lists, incomplete distribution of ballots, and sometimes, chaotic vote tabulation [43]. This happens because participating in the voting "costs" a lot of effort while it brings very limited benefit for a small shareholder, which is in line with political voting theory [44]. Empirical research shows that reducing the turnout costs for small shareholders increases their participation at AGMs [45].

Multiple studies suggest that voting based on a blockchain would significantly improve the situation with voting. The articles referenced at [9; 46] each argue that corporate voting based on blockchain would be much more transparent due to "faster, more precise vote tabulation and equal real-time transparency of the likely voting outcome for both management and dissident shareholders". This would resolve ambiguities about the outcomes of close elections (where the vote split is close to 50/50). As a result, management will lose some of its disproportionate power which will be noticed, for example, in fewer accepted management proposals related to compensation and governance.

C. Van der Elst and A. Lafarre[45] point out that blockchain would make voting, especially on annual general meetings more convenient. Shareholders would be able to vote during a short period on one or more voting items from their own desks and do not have to fill out any registration or proxy form. This would make decision-making faster, which will cut costs to companies. The same authors, in a later article [47], point out that with blockchain remote voting "becomes yet more transparent and reliable and thus further reduces the transaction costs to shareholders, which further stimulates (small) shareholder participation rates". Blockchain voting would solve a problem of identification of actual shareholders, which would facilitate participation.

W.A. Kaal [48] offers a more radical view on the implications of blockchain for voting. The author suggests that blockchain would allow firms to avoid certain corporate governance procedures like annual shareholder meetings altogether if the voting can be conducted using blockchain.

Some authors [see for example 49], who are skeptical about using existing blockchain solutions for accounting and ownership reporting purposes, are optimistic about using it for corporate voting.

S.E. De Falco et al. [50] conducted a survey of members of the board of directors and of institutional investors on expectation associated with blockchain technology. The authors confirm the attractiveness of blockchain for voting for board members. However, "the respondents said they were neutral with respect to the possible impact of the blockchain on the corruptibility to which the shareholders' meeting is subject". This shows that while the researcher community generally accepts the benefits of blockchain for voting, industry practitioners are not yet as optimistic.

Multiple articles suggest designs of systems for shareholder voting [e.g. 51; 52]. On top of that, currently there are

[1]See: http://media.broadridge.com/documents/Broadridge-PwC-ProxyPulse-1st-Edition-2015.pdf

several large-scale blockchain implementation experiments in process. See [47] for a comprehensive table of efforts with a status as of 2018.

One of the first pilots was Nasdaq's project for e-voting in Estonian AGMs in 2016. In February 2016, Nasdaq announced, in cooperation with the Estonian government, a blockchain based e-voting application which allows shareholders that hold shares in companies listed on the Tallinn Stock Exchange (belonging to Nasdaq) to vote remotely in AGMs [47]. Based on this pilot scheme, Nasdaq expanded blockchain usage to South Africa and is now also using blockchain for trading of mutual funds. The German Central Bank, together with the Deutsche Börse announced in November 2016 the development of a prototype of blockchain technology to settle securities [27].

Another example is a blockchain-based process for proxy voting introduced by CSD Working Group on Distributed Ledger Technology, which is a Consortium of Central Securities Depositories (NSD in Russia, Strate in South Africa, Six Securities Services in Switzerland, Nasdaq Nordic, and DCV in Chile), see [47] for details. The previously-mentioned Broadridge, a large proxy voting business, successfully piloted the proxy voting progress process in cooperation with J.P. Morgan, Santander Investment and Northern Trust in 2017 [53]. Currently Broadridge is expanding the effort to the territory of Japan [54].

One of the most recent pilots schemes is to establish electronic voting through the adoption of distributed ledger technology (DLT) in the Asia Pacific region by SWIFT. The project is in cooperation with securities software provider SLIB, Singapore Exchange (SGX), DBS Bank, Deutsche Bank, HSBC, and Standard Chartered Bank in Asia [55].

Yet, despite the overall positive attitude towards blockchain for corporate voting, there are, of course important issues to consider. For example, A. Lafarre and C. Van der Elst [47] highlight several issues. If voting is moved to blockchain, would traditional shareholder meetings still be necessary? If blockchain-based voting replaces the traditional shareholder meetings, will it be able to replace the forum function of the meeting? V. Maginer and P. Barban [20] argue that blockchain increases transparency of ownership, which may not be desirable to all shareholders. Authors also point out that using blockchain poses a question of liability in case of a problem. For example, if a mistake with an annual shareholder meeting results occurs, who is the liable party?

To sum up, we can see that there is a generally positive attitude towards using blockchain for corporate voting from those engaged in research as well as practitioners as it promises to solve, at least partially, long lasting problems with voting and thus mitigate the principal-agent conflict. However, all the studies surveyed are conceptual in nature. Whether the application of blockchain actually results in lower conflict within an organisation needs to be tested via empirical research.

Academic thinking on the implementation of blockchain for improving the environment expands beyond just updating the technology behind corporate voting. D. Yermak [9] argues that if instead of traditional corporate structures the firm ownership was based on the blockchain, this would create an environment where the shareholders would be automatically included in the decision making process, not just at the annual voting. This would drastically increase the governance activity by the shareholders. However, on the flipside, if a company applied smart contracts at scale, this would mean that the firm is steered in the right way almost automatically and decreases the need for active monitoring. We explore the state of research and current pilot projects further in this article.

Common observable instances of the principal-agent conflict

As mentioned earlier, we limit our analysis to the conflict between the shareholders and management. The easiest environment to observe this conflict is around corporate voting, where conflicting options are proposed by management and shareholders including both shareholder proposals and proxy contests [56]. We looked at voting as a technical process in the previous section of the article. In this section, we review the blockchain influence on the common reasons causing the conflicts at voting. On top of that, we have a closer look at investor activism as a special type of conflict.

The most common reasons for the conflict are the board of directors elections [57] and compensation schemes [58]. This is understandable, as those are classic corporate governance mechanisms. Multiple studies provide discussion on the size and structure of the board of directors [59–61], and on incentive schemes, usually aimed at increasing insider ownership [e.g. 62]. However, these and similar mechanisms rely on human decisions. Solutions based on blockchain have the potential to reduce the amount of human judgement and bring transparency to the next level [21].

In the first section of this article, we mentioned two types of blockchain application: as a ledger and smart contracts. While using blockchain as a ledger for transactions with a company's shares has similar influence on both instances of conflict, using smart contracts has different implications. We structure this section accordingly: first, we explore the impact of blockchain as a ledger; then we look separately at the impact of smart contracts for the board and compensation. Finally, we will end with a look at shareholder activism.

Using blockchain as a ledger for securities transactions

While the opaque voting process described above stimulates the conflict, other factors also contribute. One of the strategies used in corporate voting is so called 'empty voting', a situation where an investor votes with shares borrowed immediately before the vote, thus enlarging

his voting power. This is possible due to a limited speed of information dissemination on transactions with the company's securities. Most studies surveyed agree that the clearing and settlement of transactions with a company's securities using blockchain instead of traditional ledgers would potentially stop this practice [26; 27; 63]. Recording transactions with a security in blockchain is instantaneous and hence creates immediate transparency *vis-a-vis* ownership. Hence, all the stakeholders would be immediately aware of the voting rights distribution [9; 48]. Greater transparency would make conflict at voting more problematic and hence, we may expect that it would become less common.

D. Yermack [9] points out that on top of making empty voting more problematic, registering transactions using blockchain would also limit insider trading by management, since all the transactions would become more visible. A reduction in insider trading would further reduce the conflict since it won't position the management in a more favorable position to other shareholders.

There are of course certain risks associated with greater transparency. V. Magnier and P. Barban point out that if all transactions of management were immediately known to the general public, this might create more volatility with the company's shares [20].

As with the use of blockchain for voting, there are several practical implementations of blockchain for stock trading. Multiple stock exchanges, e.g. Nasdaq, Australian Stock Exchange, London Stock Exchange, and Moscow Exchange are piloting projects in this regard [47]. One of the most notable pilot projects is an effort by the Depositary Trust and Clearing Corporation, the sole provider of clearings, settlement, and custody for the US cash securities markets. Right now it is in the final stages of building a blockchain platform for credit derivatives clearing and settlement which is supposed to go live in 2019.

While the main goal of the pilot implementations described above is not a reduction of the principal-agent conflict, we can expect that it will happen as a result.

Applying smart contracts to mitigate conflicts related to the board of directors

Proposals concerning the composition of boards of directors, directors' independence, compensation, and qualifications are among the most popular proposal types that shareholders propose for voting at annual shareholder meetings [4]. The proposals related to board composition proposed by management have one of the lowest support rates [42]. It is natural for management to try to slate the board with as many "friendly" members as possible, while it is equally natural for shareholders, particularly the minority ones, to try to bring in independent directors to keep the management under control [64]. However, in a majority of cases, management effectively chooses the board, and not the other way around, as it is meant to happen [65–68]. This effectively means that management wins in the conflict.

While the implementation of blockchain for securities clearing and settlement can mitigate the conflict through identification of the securities owners, using smart contracts in particular can generate a much greater effect. C. Van der Elst and A. Lafarre [45] argue that certain technical functions of the board of directors would no longer be necessary. For example, in the EU a board of directors has a co-optation right — a right to temporarily elect a new board member if a director resigns between two AGMs. If voting is done using blockchain, this decision could be done directly by the shareholders.

There are arguments that in an organisation actively using smart contracts, certain board functions could be simplified and even automated. An example of such a function is audit. Audit is one of the major functions of boards of directors [69], and more active and independent boards execute this function more effectively, preventing earnings manipulation by management [70]. Several authors argue that blockchain can be used to generate immutable accounting records and hence drastically simplify and increase the quality of audit [9; 63; 71]. N. Rückeshäuser [72] points out that "the growing interest in this topic is also reflected by the formation of several start-ups offering blockchain-based services for decentralised bookkeeping, such as Factom or Scorechain".

The automation of this board function would weaken the conflict in two ways. First, it would allow boards to focus on strategic questions rather than technical ones, which would better serve the shareholders. Second, this would exclude the human factor from control functions and make them more accurate.

However, there are critics of blockchain for accounting. N. Rückeshäuser [72] argues that while blockchain could be useful for audit simplification, it still can be subject to fraudulent actions by management in its current form. Rückehäuser suggests ideas on how to improve the current blockchain approach to fix the problem.

Automating technical functions of the board of directors is not the most radical usage of blockchain. W.A. Kaal [48] and D. Yermack [9] argue that the application of blockchain *de facto* gives more power to shareholders to control management and hence decreases the conflict intensity and the need for the board as an instrument.

Perhaps the most extreme governance opportunity promised by smart contracts is the idea of decentralised autonomous organisations (DAOs). DAOs were originally proposed by V. Buterin [25] – the creator of the Ethereum blockchain, which serves as a platform for most smart contracts. M. Swan [12] describes DAOs as "…a concept derived from artificial intelligence. Here, a decentralised network of autonomous agents perform tasks, which can be conceived in the model of a corporation running without any human involvement under the control of a set of business rules. In a DAO, there are smart contracts as agents running on blockchains that execute ranges of prespecified or preapproved tasks based on events and changing conditions".

While the concept may seem remote, there have already been trial implementations of it. A. Kristof [32] describes a DAO investment fund built on the Ethereum platform. The fund raised 150 million dollars with the promise that only the investors would decide which projects to pursue via the usage of smart contracts. However, the computer code that encoded the smart contracts contained a minor loophole that allowed a group of hackers to freeze a significant part of the funds. To get the money back to the investors the founders of the Ethereum platform altered the computer code affecting the entire platform. The debate is still open as to whether it was an appropriate action. The very idea of blockchain and smart contracts is that the computer code is more trustworthy than people are. Some experts argue that the investors should have been more accurate studying the code before investing money [73].

This failed case showed us that while automation eliminates the original conflict, it creates a whole universe of new risks and requires a new set of capabilities. Investors and organisations need to build IT capabilities that enable them to maximise the value of blockchain while mitigating the risks.

Compensation schemes

Equity-based compensation schemes aimed at aligning incentives for shareholders and managers are one of the main tools of principal-agent conflict mitigation. H. Enayati et al. [74] show that up to 100% of Fortune 500 companies use compensation schemes linked to the total shareholder return measure depending on the industry. Yet, despite this, votes on managerial compensation still cause a lot of disagreement.

As was mentioned in the first section of this article, smart contracts allow automated execution of commitments without the involvement of a third party. Compensation is an example of such a commitment between the shareholders and the employees of a firm. If management's compensation is encoded in a smart contract that links it to the firm's performance, the conflict between management and shareholders becomes impossible, as everything is agreed and fixed at the beginning of the relationship.

The surveyed researchers generally agree on the role of smart contracts as described above. A. Wright and P. De Filippi [46] suggest a very basic form of impact of smart contracts for compensation. The authors propose that "smart contracts could be used to enable employees to be paid on an hourly or daily basis with taxes remitted to a governmental body in real time". D. Yermack [9] agrees that smart contracts may be used for compensation, and for automatic payments when performance goals are achieved.

W.A. Kaal [48] views executive compensation as a part of agency costs. The author argues that the application of blockchain for the principal-agent conflict will allow one to lower the agency costs overall, including those created by executive compensation.

However, as with the case for the board of directors, there are of course risks associated with introducing smart contracts for compensation. W.A. Kaal [48] acknowledges that while encoding compensation to smart contracts would theoretically negate the conflict, troubles similar to the case of DAO are highly probable, e.g. a fraudulent management can take advantage of a glitch in a computer code. The case of the DAO investment fund mentioned above is the perfect example of when a smart contract functions in wrong way.

There is a topic connecting cryptocurrencies and compensation schemes that currently receives a relatively modest coverage in the research literature — using blockchain-based tokens for compensation. In the first section of the article we mentioned ICOs as a blockchain-enabled way of fundraising. In an ICO, issued tokens contain and represent the value of a future project. However, a company may also issue tokens backed by an existing asset of a company. These tokens are then called asset tokens or security tokens since they resemble a company-issued security. L. Oliveira et al. [75] provide an analysis of different token types.

Y. Chen [76] analyses tokens as means of compensation, but that author limits the analysis to open-source developers participating in a project. However, there are no restrictions preventing the use of tokens for compensation for all employees. This would be useful for private companies that have no publicly-traded shares. If a company replicates shares with security tokens, those tokens may become *de facto* tradable securities available for sale 24/7, with small increments. This solution would mitigate the principal-agent for private companies. On top of serving as securities for private companies, security tokens offer the same benefits as recording transactions with securities using blockchain, i.e., an opportunity to enable the real time tracking of ownership, which we discussed earlier.

Currently there are several pilot implementations of security tokens for corporate securities. The first platform that allowed clients to trade security tokens based on actual companies' shares was the Estonia-based platform DX.Exchange, backed by Nasdaq. The platform started by offering tokens linked to Nasdaq-traded stocks with an ambition to include stocks traded on other exchanges. The benefit highlighted by the platform is its 24/7 availability for trading in securities, in contrast to the limited trading time offered by traditional exchanges [77].

The most recent one (at the time this article is written) is IX platform, backed by Singapore Exchange, which went live in July 2019. The platform (supported by an Ethereum startup, ConsenSys) "provides an IPO-like platform for private companies to raise capital and to increase liquidity in the primary capital market by using a public blockchain to validate transactions" [78]. On the platform, each token represents a company's security.

Even though security tokens offer the benefits discussed above, there are also risks. Multiple authors point out that the regulation is currently not always clear on the legal

status of various types of tokens, which creates risks for the investors [20; 75].

N. Rückeshäuser [72] argues that while direct voting by the token owners empowers owners to have a direct influence on the firm's activity, not all the owners want to have such an influence and hence would just follow the managerial proposition. This could further increase the power of management, making the conflict even more radical than before.

We conclude this part of the article with a special type of conflict – investor activism. This may be caused by any of the reasons described above, but an overview of the literature shows that blockchain influences it in a special way.

Shareholder activism

The most extreme case of the principal-agent conflict, often creating a lot of media attention, is investor activism [79] and insider activism – activist campaigns initiated by insider owners such as founders [80]. Cases of activism occur more and more frequently, even though shareholders mostly try to hold private conversations with management before going to more extreme lengths [81; 82].

Investor activist campaigns usually include accumulation of a share in a target company that allows an activist to block certain managerial decisions and push his own. Activists often try to keep the information of their ownership private as long as possible in order to maximise the gain. If a company's stock is recorded on a blockchain instead of traditional ledgers [9] or if the company uses security tokens to enhance the liquidity of shares, this increases transparency of ownership due to the immediate nature of blockchain-based transactions. Traditionally it takes several days to process and record a change in ownership with a company's security. With blockchain-based recording, such changes become immediately visible. Hence, an activist would not be able to accumulate a significant share without a market reaction. However, there is an important nuance to this argument. To create maximum transparency, the blockchain application would need to be non-anonymous. If the blockchain application used would be analogous to Bitcoin, which allows a relative anonymity of transactions, this would simplify the accumulation of stock and hence increase the chance of an activist campaign against a company.

Another argument as to why blockchain should decrease the level of conflict and the likelihood of investor activism is the presence of abnormal returns generated by the hype wave associated with blockchain. D. Pollock [83] collects a series of examples of where shares experience extreme abnormal returns following the change of name of a company or a statement that the company is now focusing on blockchain. Prominent investment banks such as J.P. Morgan [84] suggest that firms would benefit from blockchain technology, creating additional confidence for the investors.

On the other hand, there are arguments as to why blockchain application may intensify the conflict. Blockchain and smart contracts are still at the early stage of development. There is still limited evidence that implementation creates immediate value, but there have been colourful failed attempts like the DAO investment fund discussed earlier.

Booms and bursts on cryptocurrencies markets, paired with lack of legal clarity [15; 16; 85; 86] further contribute to uncertainty. This lack of certainty may scare shareholders and make them oppose managerial efforts to implement blockchain.

As with the dynamics underlying the shareholder-manager conflict, a systematic empirical analysis of the impact of blockchain implementation on the chances of shareholder activism against a company is currently lacking.

Overall, our literature overview shows that while most authors agree that blockchain has the potential to mitigate the principal-agent conflict, it can also create situations where the conflict may get stronger. For all three types of conflict surveyed, most of the works are conceptual. Quantitative proof of the influence of blockchain on the conflict, and hence on the quality of corporate governance for an organisation, is yet to be conducted.

Actions necessary to maximise the value of blockchain implementation

Blockchain is among the top digital technologies that top-management teams and boards of directors have to monitor closely [87].

Although our review shows a lack of quantitative proof of the positive influence of blockchain on corporate governance, one thing is certain: to embrace the potential benefits, firms need to choose the optimal way to implement blockchain and develop a set of competencies that enable them to benefit while mitigating the risks. While these topics are normally a subject of computer science or managerial literature, we still believe it is important to briefly address this in the final section of this article.

There are many features and nuances defining how blockchain implementation looks in a particular case. While many of those features are of a technical nature (approaches to consensus, structure of a block, etc.) [88], there is an important managerial decision to be made. That is, whether the company will implement a private, public, or a consortium blockchain. Blockchain is essentially a ledger that can only be updated once there is a consensus among the members. The type of blockchain essentially defines who are the members participating in the consensus process. In a public blockchain, all records are visible to the public and everyone can participate. In a private blockchain the creating organisation determines who can participate. The consortium blockchain is essentially a private blockchain, created by several organisations.

This choice will define the main characteristics of a blockchain, including the degree of information immutability, efficiency, and the degree of centralisation. For example, a private blockchain is the most centralised and efficient

choice as it requires relatively few members to reach a consensus to update, but this makes it easier to tweak information in it [89].

R. Beck and C. Müller-Bloch [90] point out that for successful blockchain implementation, a firm needs to develop a skillset for radical innovation that includes skills for discovery, incubation and acceleration. However, the authors acknowledge that blockchain implementation as a technological project is unique as it requires cooperation not only within an organisation, but also with other organisations.

S. Wang et al. [24] offer a different perspective on the question of the governance of blockchain projects. The authors view popular cryptocurrencies as organisations rather than an asset class. Such organisations generate value by creating transparency in the process of economic exchange. The authors discuss optimal governance solutions in light of this and provide empirical evidence that investors value the cryptocurrencies' core value proposition, which is rooted in decentralisation. However, investors are suspicious of decentralised governance at higher levels in the organisation because they could slow down strategic decision-making. These and related works [e.g. 17; 91] do not analyse ordinary organisations and do not include an empirical analysis of whether investors respond positively to the movement toward the blockchain by traditional organisations.

Yet, there are many important questions from the corporate governance perspective that are currently not sufficiently covered in research literature. What are the technical capabilities that firms need to build to successfully implement a blockchain solution. For example, are they different from other IT projects? What is an optimal way to govern a blockchain? Should there be a special board of directors committee, or a special unit in the organisation or a blockchain subsidiary? What is an optimal way to staff a blockchain implementation project? Should an industry professional be hired as a board member or a member of top-management, or should a startup be bought with an established team? These questions leave ample room for further research on this topic, and demonstrate further how the field is still in a nascent stage.

Conclusion

In this article, we surveyed the recent studies on the implications of blockchain for corporate governance. This field is relatively new and the scholarly literature is only just emerging. We focused on three corporate governance aspects affected by the blockchain application: 1) the organisational environment, and the creation of the conflict; 2) common observable instances of conflict; and 3) actions necessary to maximise the value of blockchain implementation.

Most studies surveyed indicate that blockchain has the potential to mitigate the conflict. Corporate voting based on blockchain can involve more shareholders in the process of governance, thus improving the organisational dynamics causing the conflict. Using blockchain as a ledger to record transactions with a company's securities creates transparency in shares ownership, which should make conflicts concerning shareholder votes rarer. Using blockchain in a form of smart contracts offers innovative solutions related to the elections of the board of directors and compensation schemes. There are multiple practical implementations by serious industry participants which confirm potential blockchain benefits. However, as much as blockchain is a promising solution, it creates new challenges that companies will need to address.

The evidence that we found opens broad perspectives for further quantitative research. In particular, it poses at least six questions for corporate governance. 1) How does blockchain implementation affect monitoring activity by shareholders? 2) How does blockchain implementation affect the principal-agent relationship between managers and shareholders? 3) What is the impact of blockchain investment on the likelihood of a firm being the target of an activist campaign? 4) How does blockchain technology change the relationship between the firm and stakeholders, such as clients, suppliers, employees, etc.? 5) How does blockchain technology influence traditional corporate risks? 6) What are the proactive and reactive measures boards of directors need to implement in order to mitigate the technology-related risks of blockchain application? We intend to address these questions with empirical evidence in future research.

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Premium Evaluation in Mergers and Acquisitions of Electricity Companies

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Premium Evaluation in Mergers and Acquisitions of Electricity Companies

Abstract

The purpose of this research is to build a model for estimating the relative premium in mergers and acquisitions involving electric power companies. This evaluation is based on four groups of factors: the company's operating and financial results, the country in which the company operates, the industry the company belongs to, and the debt market conjuncture.

This paper is based on a comparative business valuation method. The empirical base of this research includes data on 6504 deals that have occurred throughout the world from 1997 to 2018. This data is sourced from the Zephyr database (https://www.bvdinfo.com), which includes data on both public and non-public companies for which the amount paid in a deal is known, as well as the value of total assets.

The results of this research demonstrates that this categorisation of industries, (achieved via a mathematical algorithm) corresponds almost identically to the existing industry structure of the electric power industry. The coefficient of determination of the final econometric model is more than 20 percent, which indicates a high-quality assessment. This is because the relative premium is predicted (and not the amount paid in the deal), which is in close correlation with the value of the company's assets.

The scientific novelty of this paper consists in our clarifying of the conceptual apparatus (the relative premium term introduced in a deal), the selection and grouping of factors which affect the size of the relative premium, and the identification and quantifying of the influence of variables included in each group of factors. This article proposes the author's approach to the categorisation of countries and industries based on the equality of premium coefficients in the regression, as well as categorisation by groups of countries and industries with equal premiums.

This composition outlines a methodology that may be used to predict the value of a business, as well as determining the value paid in a deal, in cases where such information is not available publicly. This will be of obvious interest to anyone involved in business or research in several fields. Further, as concerns further development of these results, various interesting features are highlighted which are beyond the scope of this research to investigate further. For example, the relative premium seems to be determined by variables related to the quality of the institutional environment. The correlation of political stability and premium value arises, providing fresh ground for future study.

Keywords: corporate finance, financial ratios, value of firm, acquisition, buyout, merger, takeover, target firm

JEL classification:G30, G34

Introduction

This article analyses the factors that determine the amount of relative premium in mergers and acquisitions (M&As). The choice of the electric power industry is due to the fact that a significant amount of deals in this industry take place within the territory of the Russian Federation. In addition, the electric power industry is one of the basic industries of any economic system, on the development of which the dynamics of the remaining industries and services depend.

The purpose of this research is to build a model for estimating the relative premium in mergers and acquisitions of companies in the energy sector, using the comparative business valuation method.

The main hypothesis of the research is as follows: the parameters of the model for estimating the relative premium in mergers and acquisitions depend on four groups of factors: the operating and financial activities of the company, the market conditions, the industry sector of the company, and the country the company operates in or is based in.

The following results will be presented: the concept of relative premium is formulated, and a clustering of countries and industries is constructed according to the criterion of equality of relative premium in the field of electricity.

The novelty of this research approach is highlighted by the following observations, which will be explicated in the body of this article:

1) A classification of factors influencing the size of the relative premium in mergers and acquisitions deals is articulated.
2) The companies analysed are active in and related to the electric power industry. Companies in this industry have a wide range of assets, which is consistent with the objectives of the present study. Besides this, sectoral-specific risk factors and commercial motivations are more coherent and aligned than when analysing the entire market for mergers and acquisitions.
3) This analysis consists of both public and non-public companies.
4) The premium in an M&A deal is defined as the difference between the amount paid in the deal, adjusted for the acquired stake of the company, and the modelled value of the company in accordance with the size of the assets.
5) As an explanatory variable, the relative premium is identified as the quotient attained by dividing the premium in the deal by the modelled value of the company in this study. This approach allows us to unify the companies whose assets differ significantly.

Literature review and hypotheses

Considering the literature on mergers and acquisitions, it should be noted that most studies are very different from the methodology adopted in this work. First, in many studies, the dependent variable is CAR (cumulative abnormal return), which limits the analysis to public companies only. It is more informative for investors not to study the short-term reaction of the market to the appearance of information about a deal or to conclude a deal, but to analyse the premium based on the amount that was actually paid. In addition, many dependent papers use other dependent variables based on survey data. Secondly, the main goal of this work is to understand exactly what factors the country and industry premiums depend on. Understanding this will make it possible in the future for researchers or business practitioners to correctly apply the patterns obtained in other countries or other industries.

The research work cited at [7] addresses the issue of the dependence of the premium in the deal and the length of the deal's processing period. The authors concluded that increasing the time interval between the moment of hearing of the deal and the moment of announcement of the deal means an increase in premium. At the same time, the research methodology in [7] uses the CAR principle, so we would like to check these findings with respect to the relative premium.

Industry characteristics of mergers and acquisitions of Russian companies are analysed in the research work cited at [3]. The authors used the logic of distinguishing individual industries and using cross variables, which are products of industries and other variables. We use a similar methodology to assess the impact of individual industries on the parameters of mergers and acquisitions.

It is worth noting that the research methodology in the work cited at [1] cannot be fully comparable with the present study, since it is not the premium in the deal that is evaluated, but an integral assessment of the success of the deal.

The following papers provide an assessment of cultural factors affecting premiums in mergers and acquisitions. In particular, K.R. Ahern [8] draws attention to the fact that the prize negatively depends on such characteristics of the national culture as trust, hierarchy, and individualism. Drawing analogies with the objectives of this study, we can assume that countries with similar cultural characteristics should have a comparable premium and fall into clusters with the same premium size.

The research methodology in the work cited at [9] is significantly different from the assumptions of this study: the probability of becoming the object or initiator of a merger or acquisition deal is estimated. In addition, the authors examine only cross-border mergers and acquisitions. The results of the study [9] demonstrate that the level of economic development of a country and the quality of accounting affect the behavior of firms in mergers and acquisitions. The Bauer andMatzler study [10] uses data on mergers and acquisitions of European companies, and uses similar indicators characterising the level of cultural proximity of countries. The level of political affinity of countries as a factor in mergers and acquisitions was used in a study by Bertrand, as a result of which it was conclud-

ed that the political affinity of countries means a large premium in mergers and acquisitions. Applying the principle of analogy, it can be assumed that countries from groups with similar economic development may have a similar premium in mergers and acquisitions.

The importance of analysing macroeconomic factors also follows from the studies of A. Boateng et al. [11] and A. Bonaime et al. [12]. The authors of [11] conclude that macroeconomic factors are an essential variable that determines the behaviour of firms in mergers and acquisitions. The Bonaime study [12] emphasises that political factors determine the intensity of mergers and acquisitions in a particular country: a higher level of political instability means a lower intensity of mergers and acquisitions. We believe that the premium in mergers and acquisitions may also depend on the country of the deal.

Quite close factors are described in the Col and Errunza study [13]. The authors draw attention to the fact that political risks associated with the seizure of property are an essential factor determining the reaction to mergers and acquisitions. In our opinion, this hypothesis is interesting for development in the framework of evaluating premiums in mergers and acquisitions, since a high risk of property seizure should be reflected in the framework of the premium.

In a number of studies, the authors focus on the allocation of geographical factors. Y. Cai et al.[14] found that the behavior of firms located in industrial areas has significant differences. We believe that this indirectly confirms that countries with different levels of industrial development may have different premiums.

Among the studies devoted to the analysis of electric power companies, we note the work of J. Kishimoto et al. [5], which contains an analysis of mergers and acquisitions from the position of financial indicators of companies.

From Russian studies, we consider the work of A.I. Balashov and S.V. Podtsikina [15], which assesses the impact of financial parameters on the value of pharmaceutical companies in merger and acquisition deals. The authors have explored 114 mergers and acquisitions deals in the pharmaceutical industry, which had taken place from 2003 to 2014. Deals in the BRICS countries were highlighted. This research revealed that the value of the deal is affected by the volume of assets and net profit, as well as the acquired stake in the capital. In my research, dummy variables for countries were used, but countries belonging to the same region do not necessarily have an equal premium.

The research by D.S. Luzina and E.M. Rogova, cited at [16], is based on the income model of business valuation. In current research, the cost business valuation method was implemented for this indicator because forecasting of profits or dividends in the long term may have a significant error.

Summing up the analysis of political factors, we conclude that it is necessary to build a complete classification of countries from the point of view of equality of premiums in mergers and acquisitions, since different studies focus on various factors, many of which are difficult to combine in one classification. This approach, in our opinion, will contribute to the search for patterns that caused individual companies to fall into the same cluster.

Hereby we posit the hypotheses grounding the approach to this research:

Hypothesis 1. One of the factors of the relative premium in mergers and acquisitions is the total assets of the company;

Hypothesis 2. It is possible to distinguish clusters of countries characterised by the same country premium;

Hypothesis 3. It is possible to identify clusters of industries characterised by the same industry premium;

Hypothesis 4. The time interval between the rumors of a transaction, the announcement of the transaction, and the completion of the transaction, is a factor affecting the value of the relative premium;

Hypothesis 5. The situation in the debt market is a factor affecting the value of the relative premium;

Methodology and data

First, it should be noted that the modeled enterprise value was chosen, rather than the size of the equity capital. The amount paid in a deal taking into account the acquired company share (EV) most tightly depends on the modeled enterprise value (EV_m), but not on the value of the company's total or net assets.

This is confirmed by regression equations, in which the independent variable is the amount paid in a deal, adjusted for the acquired company share. The dependents in the three regression equations were the size of the modeled value (EV_m), which represents the company's total and net assets, respectively. The regressions were evaluated by the standard least squares method with a constant. In this case, the determination coefficient for the equation, in which the modeled enterprise value (EV_m) was used, is 95.32%. For the equation, in which the total company assets logarithm was used, the coefficient is 11.02%.

To conduct a comparative analysis of company value, statistical data on the conducted merger and acquisition transactions are necessary. The data source is the Zephyr database [17].

The econometric models defined in this article are based on an analysis of 6504 deals concluded between February 26, 1997 and September 30, 2018. The database included companies with industry affiliation to the 'utilities' group according to NAICS2017 classification. Companies for which the deal volume, total revenue or EBIT were unknown for the time of the transaction were excluded from the database.

Table 1 provides a quantitative description of the variables included in the study. The sample included data on companies belonging to the sectors of electricity generation and transportation.

Table 1. Descriptive statistics for variables included in investigation

	ASSETS	REVENUE	EBIT	EV	EV_D	EV_M	EV_R
Mean	7230.315	1898.704	180.6105	4679.732	−1761.39	6441.125	−21.0111
Median	451.5185	172.693	4.8265	344.7154	−37.568	475.2053	−18.105
Maximum	198929	53108	7809	148000	14403.89	148247	98.88712
Minimum	0.001	−5.051	−5045.49	0.001595	−31903.2	0.00112	−99.9954
Std. Dev.	15837.97	6321.262	677.1942	10615.91	3966.859	13688.33	29.93022
Obs.	6504	6504	6504	6504	6504	6504	6504

A grouping of factors determining the amount of premium in mergers and acquisitions was carried out for building an econometric model in this research.

An analysis of the database showed that many deals contribute to the acquisition of less than 100% of a company. Therefore, for the purposes of the analysis, an *enterprise value* (EV) variable was generated, which represents the amount paid in the deal, adjusted for the company's share acquired in this deal:

$$EV = \frac{\text{Deal value}}{\text{Acquired stake}}, \quad (1)$$

where Deal value – the amount paid in the deal;

Acquired stake – the share of the company acquired in the deal.

The analysis also uses the deal modelled enterprise value (EV_m), equal to:

$$EV_m = \text{Equity} + \text{Debt}_{LR} + \text{Debt}_{SR} + \text{Cash} \quad (2)$$

where Debt_{LR} – long-term debt;

Debt_{SR} – short-term debt;

Cash – cash and cash equivalents.

The first three components of formula (2) represent the value of the company's assets. Cash and cash equivalents are deducted because when buying a company, the owner pays the value of the assets and receives a company that owns a certain amount of cash and cash equivalents, which is equivalent to the situation when the company would have been bought for the value of assets minus cash and cash equivalents.

My approach does not take into account the size of the company's intellectual capital as a separate variable (a systematisation of features of innovative companies deals' is given in the article written by I.V. Skvortsova and A.D. Krasovitsky [18]). I think that the intangible assets of power companies are properly reflected in the relevant balance sheet items, so it is not necessary to make a separate variable for these assets.

In addition, the variable EV_d (*premium in the deal*) was generated, representing the difference between the enterprise value paid in the deal (corrected for 100% of the company) and the modelled enterprise value, determined in accordance with the logic of the cost method:

$$EV_d = EV - EV_m. \quad (3)$$

A positive value of EV_d (3) means that the company was acquired at a price higher than the value of its assets (with a premium to the value of assets). A negative value means the acquisition was at a price lower than the value of its assets (at a discount to the value of assets).

To provide for a correct analysis of the company premiums with different asset values, the relative premium was calculated (variable EV_r):

$$EV_r = \frac{EV_d}{EV_m} \cdot 100. \quad (4)$$

Relative premium, or EV_r (4) is a premium as a percentage of the modelled enterprise value. This variable was used as the dependent variable in the regression equations presented in this paper.

Herewith we present a hypothesis that the factors determining the size of the relative premium in mergers and acquisitions of electricity companies can be grouped in the following way:

1) Factors relating to the operating and financial activities of the target company;
2) Country of the target company;
3) The industry of the target company;
4) Market conditions;

Models and results

When analysing *the first group of factors* (*model 1*) (operating and financial activities of the target company), the following indicators were selected: the volume of the target company assets, the EBIT / EV_m ratio, and the sales / EV_m ratio.

A number of studies analyse the impact of financial indicators on the success of merger and acquisition deals. The most commonly used indicators are the size of the company [1–6], the profitability of the company, the profitability of the object of absorption [1; 5; 6], and asset turnover [5]. At the same time, the data on the influence of the size of

the company on the size of the bonus are contradictory: papers [1; 3; 5] indicate a positive effect of the size of the company on the size of the premium, and in the studies [2; 4; 6], a negative impact is noted. These findings predetermined particular attention to the variable reflecting the size of assets for the present study.

The logarithm of the total assets of the target company (variable assets_l) was used as a variable reflecting the size of the company's assets. The usage of the logarithm was proposed in studies [19–21], and allows for a comparison of companies whose assets differ significantly. In addition, the usage of logarithm is a way of grouping companies by assets. An alternative approach, instead of using the logarithm, is grouping companies according to the level of assets, which is used, for example, by M.V. Maslennikova and I.M. Partin [22].

As an indicator reflecting financial activities, it is proposed to use the EBIT/EV_m ratio:

$$\frac{EBIT}{EV_m}. \quad (5)$$

This indicator was chosen by analogy to the EBITDA/sales ratio, used in the research of D.Y.Aharon [19]. In this paper, I use EBIT instead of EBITDA, since this indicator, in my opinion, better reflects the cash flows available to the investor. In addition, modelled enterprise value is used instead of sales because it will make possible to assess the effectiveness of the investor's funds usage.

The ratio of the revenue to modelled enterprise value was used as an indicator reflecting the company's operating activities:

$$\frac{Revenue}{EV_m}. \quad (6)$$

This indicator was proposed by analogy to the growth rate of sales from the study cited at [19]. The inclusion of the growth rate of sales in the model may be less representative for electric power companies, since different segments of this market are characterised by different average sales growth rates. In addition, zero or negative sales trends are not always a negative factor.

To build econometric models, the data was cleared of extreme values. The enterprises with extreme values whose relative deviations EV_r exceed 100% were excluded. It appears that the acquisition of a company for a price twice that of the modelled enterprise value may be explained by the buyer's interests, possibly related to other companies that are in its ownership, which cannot be reflected in the proposed research methodology.

Based on the *factors belonging to the first group*, a regression *model 1* was constructed. The equation of model 1 is

$$EVr = \beta_0 + \beta_1 \ln(ASSETS) + \\ + \beta_2\left(\frac{EBIT}{EVm}\right) + \beta_3\left(\frac{REVENUE}{EVm}\right), \quad (7)$$

where ASSETS is the total assets of the enterprise; and β_i are the parameter estimates.

The regression parameters were estimated by the least squares method with White's robust estimates of standard deviations. The evaluation results are presented in Table 2 (model 1).

Table 2. Parameter estimates of models 1–4

Variable	Model 1		Model 2		Model 3		Model 4	
	β_i	p_i	β_i	p_i	β_i	p_i	β_i	p_i
ASSETS_L	−2.602	0.000	−2.504	0.000	−2.438	0.000	−2.424	0.000
EBIT/EV_M	0.522	0.000	0.650	0.000	0.661	0.000	0.663	0.000
REVENUE/EV_M	0.384	0.000	0.571	0.000	0.575	0.000	0.585	0.000
Group1 (Countries)			56.265	0.000	55.554	0.000	55.769	0.000
Group2 (Countries)			−0.339	0.903	0.781	0.775	2.270	0.402
Group3 (Countries)			78.986	0.000	79.845	0.000	79.661	0.000
Group4 (Countries)			63.284	0.000	63.266	0.000	63.225	0.000
France			72.454	0.000	70.684	0.000	67.794	0.000
Portugal			42.117	0.000	44.136	0.000	44.283	0.000
Russia			50.930	0.000	52.514	0.000	51.238	0.000
USA			55.546	0.000	54.817	0.000	55.577	0.000
Group 1 (Industries)					−9.199	0.000	−11.104	0.000

Variable	Model 1		Model 2		Model 3		Model 4	
	β_i	p_i	β_i	p_i	β_i	p_i	β_i	p_i
Group 2 (Industries)					−11.454	0.000	−11.344	0.000
Group 3 (Industries)					−5.650	0.008	-6.615	0.002
Group 4 (Industries)					1.489	0.515	0.612	0.787
COMPL_ANN							−0.013	0.000
COMPL_RUM							0.006	0.005
RUMR							1.996	0.000
C	−5.820	0.000	−66.948	0.000	−60.963	0.000	−61.722	0.000
R-squared	0.084		0.172		0.187		0.202	
F-statistic	197.867		123.031		99.292		91.179	
Prob(F-statistic)	0.000		0.000		0.000		0.000	

Table 3. Groups of countries by the criteria of equality of relative premiums

Group	List of countries
Group 1 (Countries)	United Arab Emirates, Austria, Australia, Bosnia and Herzegovina, Barbados, Bermuda, Bolivia, Brazil, Canada, Switzerland, Chile, Colombia, Indonesia, Ireland, India, Iran, Iceland, Jamaica, Japan, Kenya, Korea, Cayman Islands, Sri Lanka, Latvia, Morocco, Moldova, Montenegro, Macedonia, Malta, Mexico, Malaysia, Nigeria, Slovakia, El Salvador, Thailand, Virgin Islands, Hong Kong, Croatia, Italy, Luxembourg, Mauritius, Slovenia, Denmark, Estonia, Egypt, United Kingdom, New Zealand
Group 2 (Countries)	Oman, Zambia, Viet Nam
Group 3 (Countries)	Georgia, Hungary, Lithuania, Netherlands, Norway, Peru, Czech Republic, Finland, Poland, Romania, South Africa
Group 4 (Countries)	Bangladesh, Belgium, Bulgaria, China, Germany, Greece, Philippines, Pakistan, Serbia, Sweden, Turkey, Taiwan, Spain, Ukraine, Vietnam

Analysis of this model allows us to come to the following intermediate conclusions.

First, the adjusted determination of fit (the degree of linear correlation) for this model is about 8.4 percent. This indicator can be considered quite high, but of course this requires additional improvement. All coefficients of this regression are significant.

A negative coefficient of a logarithm of assets indicates that companies with a larger asset size have lower relative premiums in deals. This coefficient can be explained by the fact that large companies are subject to strict regulation by the state. In addition, the demand for such companies is lower due to the larger amount of money required for the deal.

The coefficients of $EBIT/EV_m$ and $Revenue/EV_m$ ratios are positive, which is expected. These ratios confirm that the higher the efficiency of asset usage and the higher the company's sales (which is also an indicator indirectly indicating the quality of asset utilisation), the higher the relative premium that vendors are willing to pay in the deal.

Model 2 includes the *second group of factors,* which are target company countries. Target company country was formalised by generating dummy variables, one for each country.

A sufficiently large number of countries (companies belong to 86 countries in our sample) required the formalisation of a mechanism for grouping countries. Countries are deemed as belonging to the same group when they are similar in terms of their impact on the relative premium in a deal. Countries were grouped by Wald criteria. For all countries that fall into the same group, the null hypothesis about the equality of the angular coefficients is confirmed. As a result, four groups of countries were formed. There were individual countries that are not included in any of the groups. The equation for model 2 is

$$EVr = \beta_0 + \beta_1 \ln(ASSETS) + \beta_2 (EBIT / EVm) + \\ + \beta_3 (REVENUE / EVm) + \sum_{i=4}^{7} \beta_i GrCountry_i + \\ + \beta_8 France + \beta_9 Portugal + \beta_{11} Russia + \beta_{12} USA, \quad (8)$$

where $GrCountry_i$ stands for the group of countries.

Regression (8) parameter estimates are presented in Table 2 (model 2).

Table 3 presents a list of countries corresponding to groups 1–4.

The explanatory power of this equation is significantly higher than for the previous equation (17.2 vs. 8.4%), which includes only the factors of the operating and financial activities of the company. This confirms the fact that country differences in the analysis of relative premiums in mergers and acquisitions play an important role. The coefficient for group 2, which includes Oman, Zambia, and Vietnam, was not significant in model 2, model 3 and model 4. As will be shown later, in model 5 it was possible to achieve that the angular coefficients for group 2 became significant. This can be explained by the significant difference between the sectors, which was taken into account by adding cross-variables to model 5. The largest relative premium is characteristic, therefore, of group 3 and also of France, that is, mainly for the countries of Western and Eastern Europe. The smallest value is typical for Oman, Zambia, and Vietnam.

It seems that, perhaps, the relative premium is not determined by the country's location or the influence of macroeconomic factors only, but by variables related to the quality of the institutional environment. It is not by chance that the minimum relative premium is typical for countries with a low degree of political stability, and the maximum premium attaches to politically stable states. I suppose that testing this hypothesis is beyond the scope of this research, however, it can pose an interesting subject for further analysis.

Nevertheless, it should be recognised that the structure of clusters obtained as a result of the algorithm's operation does not correspond either to the generally accepted geographical structure of the world or to the classification of countries by level of economic development. Adding interest rates to the model made it possible not to include the time factor in the model, in particular, such events as the moment of adoption of legislation on deregulation of the electricity market.

The results of my work show that the use of existing classifications of countries (as was done, for example, in [15] by introducing a dummy variable for BRICS countries) is not sufficiently justified in analysing the premium in mergers and acquisitions. The issue of building classification for individual industries also requires further development, which was done at the next stage.

The *third group of factors* were included in the analysis and built model 3. These are industries belonging to the target companies. Industries were included in the same way as countries. The dummy variables were generated for every industry. The industries grouping was carried as for countries too. The resulting regression equation is

$$EVr = \beta_0 + \beta_1 \ln(ASSETS) + \beta_2 (EBIT / EVm) + \\ + \beta_3 (REVENUE / EVm) + \sum_{i=4}^{7} \beta_i GrCountry_i + \\ + \beta_8 France + \beta_9 Portugal + \beta_{11} Russia + \beta_{12} USA + \\ + \sum_{i=13}^{16} \beta_i GrIndustries, \quad (9)$$

where $GrIndustry_i$ – i-s group of industries.

Equation (9) parameter estimates are presented in Table 2 (model 3).

Table 4 presents a list of industries corresponding to groups 1–4.

Table 4. Groups of industries by the criterion of equality of relative premium

Group	List of industries
Group1 (Industries)	Bituminous Coal Underground Mining Commodity Contracts Dealing Data Processing, Hosting, and Related Services Electric Bulk Power Transmission and Control Electric Power Distribution Fabricated Structural Metal Manufacturing Hydroelectric Power Generation
Group 2 (Industries)	Steam and Air-Conditioning Supply Wind Electric Power Generation
Group 3 (Industries)	Fossil Fuel Electric Power Generation Geothermal Electric Power Generation Nuclear Electric Power Generation Other Electric Power Generation Power and Communication Line and Related Structures Construction Solar Electric Power Generation Water Supply and Irrigation Systems
Group 4 (Industries)	Natural Gas Distribution Sewage Treatment Facilities

After the addition of the industries factor, determination increased slightly, from 17.2 to 18.7%. For the industries factor, a result similar to that was expected, corresponding to *a priori* ideas. Group 1 includes industries related to power transmission. Group 3 includes industries related to power generation. The relative premium for industries from group 3 is higher than for industries from group 1. At the same time, for industries from group 4, the relative premium was significantly different from zero in any of the applicable regression equation specifications (model 3, model 4, model 5).

For analysing the effect of factors, that related to market conditions, the following variables were used:

a) time interval between the moment of the announcement of the deal and the completion of the deal;

b) time interval between the moment of rumour and the completion of the deal;

c) Euribor at the time of the rumour (source [17]).

The market interest rate in the framework of the income method was applied as per L. Li and W.H.S. Tong [23]. The idea of using interest rates as a criterion for assessing the debt market is an alternative to using data on the spread of government bonds (described in the article by I.I. Rodionov and V.B. Mikhalchuk [24, p. 104]) and makes it possible to assess the world market, rather than national markets.

The corresponding regression equation is

$$\begin{aligned}&\mathrm{EVr} = \beta_0 + \beta_1 \ln(\mathrm{ASSETS}) + \beta_2 (\mathrm{EBIT}/\mathrm{EVm}) + \\ &+\beta_3 (\mathrm{REVENUE}/\mathrm{EVm}) + \sum_{i=4}^{7} \beta_i \mathrm{GrCountry}_i + \\ &+\beta_8 \mathrm{France} + \beta_9 \mathrm{Portugal} + \beta_{11} \mathrm{Russia} + \beta_{12} \mathrm{USA} + \\ &+\sum_{i=13}^{16} \beta_i \mathrm{GrIndustries} + \beta_{17} \mathrm{COMPL}_{\mathrm{ANN}} + \\ &+\beta_{18} \mathrm{COMPL}_{\mathrm{RUM}} + \beta_{19} \mathrm{RUMR}\end{aligned} \quad (10)$$

where $\mathrm{COMPL}_{\mathrm{ANN}}$ represents the deal announcement time interval; $\mathrm{COMPL}_{\mathrm{RUM}}$ stands for the deal rumor time interval; and RUMR is the Euribor value at the time of the deal rumor.

Estimation results are presented in table 2 (model 4).

The addition of three variables to the model which related to market conditions allowed for an increase in the determination from 18.7 to 20.2%.

The negative coefficient of the variable reflecting the time period from the moment of the announcement of the deal to the moment of completion of the deal, confirms the fact that companies are eager to complete deals which are more desirable for the initiator, and so pay a higher relative premium.

A positive coefficient for the variable reflecting the time period from the moment of rumour to the moment of completion of the deal means that a long discussion of the deal's parametersbetween the parties concerned leads to a greater likelihood of trading relative to the deal amount, which ultimately leads to a reduction in the relative premium.

A positive coefficient for the RUMR variable establishes an increase in the relative premium in a deal with an increase in the Euribor interest rate.

In fact, when financing a deal, credit funds are often used. An increase in the interest rate of Euribor leads to higher credit interest rates, so companies implement only the most profitable deals in terms of the expected effect, for which the relative premium is higher. In addition, investing in the M&A market and in financial assets are alternative tools. It should be emphasised that the methodology of this study examines the global capital market as a comprehensive whole. The specifics of developed or developing capital markets, as well as the specifics of the capital markets of individual countries, are beyond the scope of this work.

The coefficient's estimates are stable (the signs were the same and the estimates themselves changed slightly) when new groups of factors are added. This is indirect evidence of the robustness of the estimates obtained. The sequential addition of four groups of factors while maintaining the values of the regression coefficients indirectly suggests the sustainability of those factors assessments. The coefficients values from the previous equations remain stable and do not significantly change when new factors were added.

Cross-variables were added to form the *final specification* of the regression model *(model 5)*. On the basis of the original full set of cross-variables, significant factors were selected. As a result, model 5 was built. Initially, all possible cross-variables were added to build the equation, and then the ones that were only significant at the level of five percent were included. The resulting regression equation is as follows:

$$\begin{aligned}&\mathrm{EVr} = \beta_0 + \beta_1 \ln(\mathrm{ASSETS}) + \beta_2 (\mathrm{EBIT}/\mathrm{EVm}) + \\ &+\beta_3 (\mathrm{REVENUE}/\mathrm{EVm}) + \sum_{i=4}^{7} \beta_i \mathrm{GrCountry}_i + \\ &+\beta_8 \mathrm{France} + \beta_9 \mathrm{Portugal} + \beta_{11} \mathrm{Russia} + \beta_{12} \mathrm{USA} + \\ &+\sum_{i=13}^{16} \beta_i \mathrm{GrIndustries} + \beta_{17} \mathrm{COMPL}_{\mathrm{ANN}} + \\ &+\beta_{18} \mathrm{COMPL}_{\mathrm{RUM}} + \beta_{19} \mathrm{RUMR} + \\ &+\beta_{20} \mathrm{GrCountries}_2 * \mathrm{GrIndustries}_1 + \\ &+\beta_{21} \mathrm{Portugal} * \mathrm{GrIndustries}_2 + \\ &+\beta_{22} \mathrm{Russia} * \mathrm{GrIndustries}_2 + \\ &+\beta_{23} \mathrm{GrCountries}_3 * \mathrm{GrIndustries}_4 + \\ &+\beta_{24} \mathrm{USA} * \mathrm{GrIndustries}_4 .\end{aligned} \quad (11)$$

Parameter estimates are presented in Table 5 (model 5).

Table 5. Parameter estimates of model 5

Variable	Model 5	
	β_i	p_i
ASSETS_L	−2.505	0.000
EBIT/EV_M	0.663	0.000
REVENUE/EV_M	0.604	0.000
ACQUIRED_STAKE	−0.026	0.069
COMPL_ANN	−0.013	0.000
COMPL_RUM	0.006	0.009
RUMR	194.200	0.000
Group 1 (Countries)	58.344	0.000
Group 2 (Countries)	7.807	0.069
Group 3 (Countries)	83.446	0.000
Group 4 (Countries)	65.721	0.000
France	72.402	0.000
Portugal	45.921	0.000
Russia	51.636	0.000
USA	61.105	0.000
Group 1 (Industries)	−10.267	0.000
Group 2 (Industries)	−13.889	0.000
Group 3 (Industries)	−6.579	0.002
Group 4 (Industries)	2.181	0.351
Group 2 (Countries)*Group 1 (Industries)	−9.629	0.071
Portugal *Group 2 (Industries)	20.750	0.001
Russia *Group 2 (Industries)	16.156	0.000
Group 3 (Countries)*Group 4 (Industries)	−13.190	0.000
France *Group 4 (Industries)	−12.000	0.000
Russia *Group 4 (Industries)	13.683	0.011
USA *Group 4 (Industries)	−14.026	0.007
C	−63.496	0.000
R-squared	0.210	
F-statistic	66.233	
Prob(F-statistic)	0.000	

For the final model specification, the Variance Inflation Factors (VIF) calculation was performed, indicating that there is no highly significant multicollinearity in the model 5 (Table A1).

To assess the quality of the proposed model specification, a Ramsey test was carried out, confirming the absence of significant non-linear components that were not included in model 5 (Table A2).

Adding cross-variables improved the quality of the final regression model, which is confirmed by an increase in the coefficient of determination from 20.2 to 21.0%. In addition, it should be noted that the probability value for the t-statistic and F-statistic indicators increased, which also indicates an improvement in the quality of estimation in model 5.

As a result of the inclusion of cross-variables, the influence of the countries of the second group became significant. This is unlikely to be the same for previous models, where the second group countries did not have a significant impact on the relative premium. As for the fourth group, its influence remained insignificant.

Our results can be interpreted as follows. As the size of the company's assets increases, the relative premium decreases, the ratio of the value increases EBIT to the simulated value of the business, as well as the amount of revenue to the simulated value of the business, and the relative premium increases perception of the existence of a control bonus. A one percentage point increase in the Euribor interest rate leads to a relative premium increase of about 1.94 per cent.

Countries and individual groups of countries, as well as industries, have a country premium or discount. For all groups of industries except the fourth group, the premium is statistically significant.

In addition, in our opinion, the premium of 20.75 and 16.16% respectively for companies in Portugal and Russia belonging to group 2 industries is particularly interesting. This indirectly demonstrates the high potential of knowledge-intensive and innovative industries in these countries. It is natural to have a premium of 13.68% for the branches of group 4 of Russia.

Analysis of the final model's specification confirms all the patterns obtained in previous models. In addition, it was concluded that the production and transportation of natural gas, as well as the transportation of wastewater, are industries that are characterised by a significant difference in the relative premium between countries: Russia is characterised by a positive relative premium, while for others countries the relative premium is negative. This conclusion is fully confirmed by empirical data that indicate low competition in the gas market in Russia.

Conclusions and considerations

Summing up the analysis, we come to the following conclusions. All four selected groups of factors (operational and financial activities of the target company, country of belonging for the target company, industry of belonging

for the target company, and market conditions) are significant from the point of view of determining the relative premium in the deal.

Some of the conclusions obtained in this research fully confirm existing well-known facts. From the point of view of scientific novelty, the following conclusions are interesting:

1) The relative premium in mergers and acquisitions is a function of the value of a company's assets. For companies with large assets, on average, a lower relative premium is typical.
2) The hypothesis that companies belonging to the same geographic region (or one group of countries according to the criterion of economic development) are characterised by an equal relative premium is not confirmed.
3) Companies belonging to the electricity generation and transportation sector have different relative premiums in mergers and acquisitions, with a lower relative premium for the generation sector.
4) The time interval between the rumour about the deal, the announcement of the deal, and the completion of the deal significantly influences the relative premium.
5) The conjuncture of the debt market, namely the value of the Euribor interest rate, refers to factors that significantly affect the relative premium in deals: an increase in the Euribor value leads to an increase in the relative premium in deals.

Thus, in this article, classification of countries and industries from the standpoint of equality of relative premiums in mergers and acquisitions in the electric power industry was constructed. It was concluded that the existing classification of industries within the electric power industry is applicable from the standpoint of evaluating relative premiums in mergers and acquisitions. In addition, it was concluded that the existing country classifications cannot be applicable from the perspective of evaluating relative premiums in mergers and acquisitions; therefore, a new country classification was proposed.

Further development of this model may include the creation of a new classification of countries applicable to the analysis of mergers and acquisitions.

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Appendices

Table A1. VIF model 5

Variable	VIF
ASSETS_L	1.701
EBIT/EV_M	3.255
REVENUE/EV_M	3.408
ACQUIRED_STAKE	1.554
COMPL_ANN	4.204
COMPL_RUM	4.374
RUMR	1.225
Group 1 (Countries)	35.878
Group 2 (Countries)	3.645
Group 3 (Countries)	23.003
Group 4 (Countries)	34.473
France	19.490
Portugal	10.790
Russia	13.283
USA	4.812
Group 1 (Industries)	10.935
Group 2 (Industries)	3.539
Group 3 (Industries)	11.021
Group 4 (Industries)	7.074
Group 2 (Countries)*Group1 (Industries)	2.788
Portugal *Group 2 (Industries)	1.133
Russia *Group 2 (Industries)	1.363
Group 3 (Countries)*Group 4 (Industries)	1.505
France *Group 4 (Industries)	2.219
Russia *Group 4 (Industries)	1.141
USA *Group 4 (Industries)	1.386
C	

Table A2. Ramsey test for model 5

Variable	Value	df	Probability
t-statistic	1.280	6476.000	0.201
F-statistic	1.639	(1, 6476)	0.201
Likelihood ratio	1.646	1.000	0.200

Influence of Corporate Taxation on the Financial Leverage of Czech, Polishand Russian Companies

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Influence of Corporate Taxation on the Financial Leverage of Czech, Polishand Russian Companies

Abstract

This article aims to compare and contrast the available empirical evidence concerning the capital structure of Polish, Czech and Russian companies. This is an intriguing research area due to the fact that the Czech and Polish economies began their transition to the market economy contemporaneously with Russia, and so along with other cultural and historical parallels, the data is comparable.

We compare data from a selection of large companies from the selected territories and investigate whether effective tax rate is significant determinant of capital structure. The selected sample is comprised of 69 companies (50 from Russia, 9 from Poland, and 10 from Czech Republic), using data over a period of fourteen years. We perform a regression analysis and interpret the results using theoretical knowledge as articulated in the academic literature. The dependent variable in all tested regressions is financial leverage, calculated as the ratio of the sum of short-term and long-term debts to the sum of short-term and long-term assets. Other variables evaluated include interest coverage ratio, the level of company tangibility, and the cost of debt. This set of input values was uploaded from the Bloomberg database.

Our results indicate that taxation does have determining effect on the choice of a certain level of leverage. Moreover, the effective tax rate represents the most important factor in determining the model of capital structure utilised by large companies in each country studied. We establish the dependence of capital structure models on the level of corporate tax applied in each country and identify a set of additional determinants which play a significant role.

This paper's novelty may be summarised as representing an advanced understanding of specific aspects of influence of the corporate taxation on the capital structure of companies in Russia and other economies of the former Eastern Bloc. This paper shines a new light on the subject area by extending the duration of the studied data beyond previous research, to fourteen years. As such, in this paper we present a comparitive dynamic which may be mapped on to other similar comparitive studies. Our results will be of interest in professionals and academics who are involved in the fields of taxation, debt and equity in Eastern Europe and Russia. The schema utilised here may be applied in a similar manner to examine the development of similar economies in Eastern Europe and further afield.

Keywords: financial leverage (leverage); capital structure; corporate taxation; debt financing of projects; effective tax rate; interest coverage ratio; company materiality level; cost of debt; interest coverage level; pooled-regression; between-regression; fixed effects within-regression; random effects within-regression;

JEL: G30, G32

Introduction

The principles of capital structure formation have been a primary area of interest in academic research for 50 years. This is because an optimal financial leverage plan may significantly improve the financial performance of a company. Moreover, a patternless formation of financial leverage can be detrimental to the company's value in a volatile economic environment. The methods used to create and maintain one or another form of capital structure are equally important. An unsystematic raising of debt financing results in an uncontrolled growth of interest charge. The latter, in its turn, is often a cause of tangible losses.

The overall purpose of this article is to compare empirical evidence on the capital structure of Polish, Czech, and Russian companies. The objective is achieved by comparing determinants of the capital structure of large companies from Poland and Czech Republic against those of large Russian companies. In the process, it was discovered that taxation exercises a determining effect on the choice of a certain level of leverage.

In order to parse and explicate this discovery, it is necessary to define a set of determinants which should be tested, along with identifying the effective taxation level. For example, if it is found out that at any particular moment (in our case it is once a year) the financial leverage is defined by the effective taxation level for Russian, Polish and Czech companies, one may postulate the existence of a significant macroeconomic factor of influence on the capital structures of the companies in the studied sample.

It should be noted that the idea of such a study is neither new nor unique, as there have been papers published on the capital structure of Russian companies and companies fromEastern Europe. Nevertheless, there are no publications for these countries with as long a time span as fourteen years.

Theoretical Considerations

More recently, the importance of the capital structure has increased rapidly for large companies performing activities in emerging markets. The reason for such a heightening of interest is high instability in business environments related to political conflicts. Nevertheless, the fundamental principles of capital structure formation are not as volatile as geopolitical relations.

There are two main theories which explain the choice of capital structure by companies: the pecking order hypothesis (DeAngelo, Masulis, 1980; Kim, 1982; Modigliani, 1982) and the tradeoff theory (Nicholas, Stewart, 1984). It was found that the explanatory power of each theory depends strongly on the selection of companies and the method of their study (Graham, 2011; Ivashkovskaya, Solntseva 2010). There is also a lot of research which aligns with the principles of capital structure formation in emerging capital markets which cannot be described by just one of these theories, as it depends largely on the determinants included in the model (Ivashkovskaya, Makarov 2010). This notwithstanding, we do not intend to define which of the two theories is better in general, or which describes in more detail the principles of choice of the financial leverage by Russian, Polish and Czech companies. Our objective is to define whether the effective tax rate in general is a significant determinant in the model of the capital structure choice for the companies from the countries studied in this article. Then we should find out whether it is determinative in the models of such choice.

Research on the Influence of Taxation on Capital Structure

In 2012 a paper was published which studied the issue of how the changes in the tax legislation in 2001 influenced changes in the capital structure of companies in Croatia (Klapper, Tzioumis, 2012). The particular contribution of this paper was that it studied corporate taxation, as it was the only sphere that changed. This helped to outline the influence of the corporate tax rate on capital structure directly, without the use of any approximate values. In the course of the reforms in Croatia mentioned in that paper, corporate tax rates were decreased, which reduced the level of financial leverage in many companies. As a result of this research, the authors concluded that large companies are almost unresponsive to changes in the tax rate. This accounts for the fact that large companies have access to tax privileges, and therefore they depend little on the corporate tax rate.

Other authors also studied influence of tax rates on the capital structure (Overesch, Voeller, 2010). The most meaningful among them was the set of regressors used to build the model, and a part of those determinants was used in the present research. The regression model comprised the following: company profitability, the share of tangible assets, size, and indicators related to taxes, etc. Finally, the authors of the article defined that the effective tax rate had a positive impact on the financial leverage level.

Apart from the fact that the corporate income tax rate should be included in the model of capital structure formation, it was established that the best choice for this is the effective tax rate (Graham, 1996).

There is also a view that the corporate tax rate is not the factor defining the financial leverage in every instance. To be more accurate, it has been affirmed that one should not only include corporate taxation in such models (Dhalival, Heitzman, Zhen Li, 2005). This is because the capital structure influences the interest payment and dividend payout policy, and consequently affects shareholders' benefits. As such, the shareholders may influence managers in order to maximise their own earnings, especially if the managers pay out dividends readily. It is necessary to include an individual tax rate in the model in addition to the corporate tax rate, if possible.

Research on the Influence of Other Determinants of the Capital Structure

The availability of debt financing for projects has an influence on the capital structure formation just as much as other factors (Faulkender, Petersen, 2004). Availability of debt financing entails that a company is listed on the stock market and has access to the bond market, and that a rating agency has rated the company. The abovementioned article discovered that if a company has access to the open market, then its financial leverage (debt-to-asset ratio) exceeded by 35% the financial leverage of the companies which borrowed only from the local banking system.

Credit rating is not the only factor which influences the capital structure of a company. A certain level of the credit rating is of particular importance. If a company has a "bordering" rating (for example, AA+ or BB–) it generally tries to maintain a stable level of financial leverage. On the other hand, if a company has a "median" rating (for example, AA or BBB) it tends to be actively involved in the change of its financial leverage because in this case even if the leverage grows (or reduces) the company credit significantly, the rating will just transform into the bordering figure (Kisgen, 2006).

If the cost of debt decreases significantly, we may observe a change in company capital structure as follows. The company increases the debt amount not just for project financing, but for the redemption of its own stock as well (Chevalier, 1995). The cost of debt may be more than just a factor influencing choice of the capital structure which the company should maintain. It is not uncommon that due to whatever limitations, a company sets its capital structure in some order, and then tries to change the sources of its debt financing rapidly in order to minimize expenses (Koyama, 1993).

The next important factor which influences capital structure is company size. Some researchers have discovered that the debt amount of a company correlates positively to its size (a big company implies a predominance of fixed assets in the assets category, and consequently, the existence of a reliable security), except for the cases when a company has just started its operations. The latter case accounts for the fact that very often a company has not enough money to start its business, and therefore debt financing may be raised even if there is no sufficient amount of fixed assets (Kurshev, Strebulaev, 2005).

The tax legislation shows the procedure of capital structure formation from another point of view. The "tax shield" concept comprises several strategies of choice for the format of financial leverage for corporations.Companies invariable perform a continuous search for their optimal financial leverage arrangement, walking a delicate line between the risk of default and the benefits of tax saving (Auerbach, 1985). For example, there is a popular opinion that introducing a progressive taxation encourages growth of the debt amount in large companies (Miller, 1977).

Analysis of a selection of Dutch companies showed that such characteristics as company size, share of fixed assets in the assets structure, and assets earning power each have a positive impact on financial leverage (Chen, 1998).

Methodology and Hypotheses

We perform a regression analysis in this research, and interpret the results using theoretical knowledge, as articulated in the academic literature. The dependent variable in all tested regressions is financial leverage, which is calculated as the ratio of the sum of short-term and long-term debts to the sum of short-term and long-term assets, as this precise set of input values was uploaded from the Bloomberg database. This indicator is equivalent to the ratio of aggregate debt to aggregate assets, but it is not the only manner of calculation. For example, leverage is also sometimes calculated as the ratio of aggregate debt to equity capital. However, to be more definite, the first approach was chosen.

The tax level (effective tax rate) is the first applied regressor, which will be the key variable in the tested hypotheses. This parameter was calculated as the ratio of income tax payments for a period to EBT (earnings before taxes). In order to test the hypotheses set forth below, some variables were created: interest coverage ratio (the ratio of earnings before interests and taxes to interest expenses), the level of company tangibility (the ratio of long-term assets to the company's aggregate assets), cost of debt (the ratio of interest expenses to aggregate debt). As for the company's tangibility level, it should be added that it is not entirely correct to simply consider the companies' long-term assets as fixed assets which may be put at stake (in the form of pledge, or collateral) to aid the cause of raising debt capital. Nevertheless, taking into account the absence of information concerning the amount of fixed assets of each company, the ratio of long-term assets to aggregate assets may be an approximant when calculating the value of the company. Apart from the created variables, the model also comprises a variable uploaded beforehand – ROA (return on assets). The issue of the value of interest coverage should be also clarified. No research has been found which tests the influence of precisely this factor on the financial leverage. However, we believe that a confirmation of negative dependence between the cost of debt and financial leverage is a sufficient foundation for including interest coverage level into the model of capital structure formation. This is because even if the cost of debt rises significantly, then at a high ratio of interest coverage, a company may go on increasing debt when it needs additional financing.

We will now discuss the hypotheses to be tested in this research. The first hypothesis consists in verifying whether the effective tax rate is a significant factor in the model of the capital structure formation of large companies in Russia, Poland and Czech Republic. Therefore, the first hypothesis is phrased as follows:

H1: the effective tax rate is a significant factor in the models of capital structure formation for large companies in Russia, Poland and Czech Republic

In case of confirmation of the first hypothesis it seems appropriate to test the second hypothesis, which is articulated as follows:

H2: the effective tax rate is a significant factor in the models of the capital structure formation of large companies in Russia, Poland and Czech Republic, if among other factors introduced in the regression equations there is no other factor which at the same time: 1) is significant in regression equations for each of the three countries and 2) is more significant than the effective tax rate in the majority of regression equations.

Data and Model Specification

Data regarding various indicators of large nonfinancial companies were selected for this research: Russia (50 companies), Poland (9 companies) and Czech Republic (10 companies). These are public companies and have the following indexes: MICEX (Russia), WIG-POLAND (Poland) and PX Index (Czech Republic). These figures are exclusive of companies which were omitted from the selection as their available data contained too many omissions in the downloaded parameters. Russia was chosen as the 'main' country due to the amount of available information, and in order to explicate further the results of its macroeconomic policies. The main criterion for choosing the other two countries for analysis was the fact that they and Russia have long existed in the environment of the command economy and then virtually simultaneously changed over to the market economy. This particular fact confers the possibility of testing the significance of influence of taxation on the capital structure as one of few factors which shows radically different values in these three countries. The following indicators were uploaded from the Bloomberg database for the period of 2001 to 2017 concerning companies from the abovementioned countries: short-term debt, long-term debt, current assets, non-current assets, income tax, EBIT, interest expenses, ROA, market capitalisation.

Indicators such as leverage, tax level, interest coverage ratio, tangibility and cost of debt were also calculated. The selections for Poland and Czech Republic were balanced in order to have values on all indicators for the whole studied period. This allows for the surpassing of the assessments displacement of regression coefficients. Nevertheless, it was impossible to perform this balancing completely for Russian companies because it would have resulted in a significant reduction of the selection. Several indicators for each year are missing from the data for the 50 companies remaining for analysis. In order to make the conducted analysis justifiable, the set of companies for each country was unchanged for the whole analyzed period.

In order to build regressions, either specific values, or natural logarithms of base parameters were used. Thus, the following type of model was tested:

$$LEVERAGE_t = b_1 \cdot LN\_TAX\_LEVEL_{t-1} + b_2 \cdot LN\_CAPITAL_{t-1} + b_3 \cdot \cdot INT\_COVERAGE_{t-1} + b_4 \cdot TANGIBILITY_{t-1} + b_5 \cdot ROA_{t-1} + b_6 \cdot COST\_OF\_DEBT_{t-1},$$

where LEVERAGE – financial leverage; LN_TAX_LEVEL – natural logarithm of the effective tax rate; LN_CAPITAL – natural logarithm of the capital (assets) sum; INT_COVERAGE – interest coverage ratio; TANGIBILITY – level of a company materiality; ROA – return on assets, COST_OF_DEBT – cost of debt; b_i – regression coefficients.

In this regression the dependent variable is taken from one period and all regressors are taken from the previous period, i.e. with a one-year lag. This is done on the basis of an assumption that the current value was defined in an optimal way as a response to the results of analysis of the previous period's indicators. Inclusion of the current period repressors may produce the endogeneity problem, because the current value of repressors is to a great extent defined by the value of financial leverage in the current period.

Instead of the lagged variables of the effective tax rate and capitalization, their natural logarithms were taken. In case of capitalization it was done in order to level down the difference in the size of companies. In spite of the fact that only large companies which keep accounts in accordance with International Financial Reporting Standards were chosen for the analysis, the difference in the size is still significant (the selected companies' capitalization varies from tens of millions to tens of billions of US dollars). The logarithm of the effective tax rate was taken merely because in the data pretesting, the quality of regressions was in all cases higher when using precisely the naturally logged value of the effective tax rate.

In accordance with the most widespread provisions of the papers mentioned in the literature review, the following dependencies of capital structure on the chosen factors are expected: the financial leverage will have a negative dependence on the cost of debt and return on assets, while the dependence on the tax level, market capitalization, amount of interest coverage and the share of fixed assets in the company assets will be positive.

Russian Companies

We built four types of regressions:

1) Pooled-regression – this model does not take into consideration either temporal effects, or individual effects;
2) Between-regression – this model does not take into account the temporal effect (in this regression the values of indicators for individuals are time-averaged);
3) Fixed effects within-regression (FE) – this regression is built in the deviations of indicators from the time-averaged indicator for each item. At the same time it is presumed that each company adds its individual effect as a constant to the main constant of the regression;
4) Random effects within-regression (RE) – the essence of this model consists in the fact that, unlike in the FE model, the individual effect is in the form of an error instead of a constant.

Table 1. The final regression for the selection of Russian companies

LEVERAGE	Coaf.	Std.Err	t	P> | t |	(95% Conf. Interval)	
1_LN_TAX_LEVEL	.0490474	.0106026	2.85	0,008	-.463206	0.317742
1_LN_CAPITAL	.0374842	.0168394	2.22	0,031	.0033063	0.414621
1_INT_COVERAGE	-6.73e-07	1.83-e07	-3.65	0,001	-1.03e06	-3.01e-07
1_ROA	-.003131	.0008037	-3.90	0,000	-.0047308	-.0015112
_cona	-.0574146	.136484	-0.37	0,715	-.3727873	.2379582
sigma_u	.15433161					
sigma_e	.08738946					
rho	.75721261	(fraction of variance due to u_1)				

Source: calculated by the author.

On the basis of the results of F-test we have to opt out of the pooled-model in favour of the FE model. However, the Breusch-Pagan test shows that the RE model is the most preferable one.

Then we have to make our choice between FE and RE models. However, before that, one can notice that in both models the variables l_COST_OF_DEBT and l_TANGIBILITY are not significant even at the 10% level of admissible error. Consequently, we will exclude these variables from the analysis when making further comparison of FE and RE models.

The insignificance of the variable l_COST_OF_DEBT may be accounted for by the fact that in Russia, the cost of raising debt will be cheaper in the majority of cases than that of raising additional equity capital. Therefore, one is almost always ready to pay the quoted price for the use of the debt, because a decision on the issue of debt securities or the obtaining of credit is defined by other factors. As for the variable l_TANGIBILITY, its insignificance may be accounted for by the fact that Russian financial directors do not adequately take into consideration the existence of pledge assets when they take a decision on a change of the financial leverage.

If we consider these two factors together, we may make a more general conclusion that Russian corporations take decisions on a change of the financial leverage on the basis of the company's needs in additional financing and not on the basis of the company's ability to have a debt load with little risk.

Now, we will build the regression models and compare FE and RE regressions to the new set of variables.

Then we conduct the Hausman test. As a result of this test we find out that if we choose RE model the quality of the results will go down, therefore we should choose FE model.We shall also verify our regression for heteroscedasticity and autocorrelation. To verify the first problem, we apply the Wald test. On the basis of the results of this test one can make a conclusion on existence of heteroscedasticity. Consequently, it is necessary to apply a robust estimator of the regression coefficients when building the regression.

In order to test autocorrelation we will apply the Wooldridge test. The test showed that autocorrelation exists. Nevertheless, we cannot weaken its influence within this selection for two reasons. First, for the *xtreg* function, the method of weakening of autocorrelation using only clusterisation is applied. Second, our selection is not large enough to divide it into clusters.

The final regression for the selection of Russian companies is presented in Table. 1.

Coefficient Interpretation

LN_TAX_LEVEL: The sign is positive for this variable, and as expected by the hypotheses, it accords with opinions expressed in existing research. It appears that the fact that a growth in paid taxes urges financial directors to increase financial leverage for the purpose of tax saving is applicable to Russian companies.

LN_CAPITAL: The sign is positive for this variable, and it accords with the assumptions made before conducting the analysis. This accounts for the fact that companies with high capitalisation feel more confident in the capital market and it is easier for them to come to an agreement concerning favourable terms of debt raising, and as a consequence, their financial leverage is bigger.

INT_COVERAGE: The coefficient significance at interest coverage is at the bordering-significance level (error probability 0.136). Nevertheless, this parameter was not excluded from the regression. It is important to note that the sign for this variable was in contrast to the sign expected in accordance with the hypothesis. This may be explained as follows: if a company has a very high interest coverage, later it will also have a high pretax profit as well

as net profit. It follows that in most cases the company has enough money to satisfy its needs and it does not need to raise debts.

ROA: The sign is negative for this coefficient, and this confirms our hypothesis, and validated the following articulation: if return on assets is high, the net profit flows are enough to finance the company needs, and there is no need to raise debt capital.

Polish companies

The results of building of each separate regression are shown in Appendix 3. Below is a summary table of regression coefficients indicating the level of significance of each of them.

We failed to build the between-regression because the selection is not large enough. On the basis of the results of the F-test we have to opt out of the pooled-model in favour of FE.

The Breusch-Pagan test helps to compare the pooled model and RE model.

As we see, this hypothesis is not rejected, so we have to verify the fact that the FE model shows better accuracy results than the RE model. In this case it is not important for us which model is better: the pooled or the RE model. But before that one can notice that in both models the variables l_TANGIBILITY and l_ROA are not significant even at the 10% level of admissible error for the selection of Polish companies. Consequently, we will exclude these variables from the analysis when making further comparison of FE and RE models.

Insignificance of the variable l_ROA may be accounted for by the fact that in Poland the return on assets in the majority of cases does not serve as a guideline for changing the financial leverage. Therefore, the decision on raising debt financing will be defined by the needs of financing in general, and not by the way it will influence the overall benefit from company assets. As for the variable l_TANGIBILITY, its insignificance may be accounted for by the fact that the existence of pledge assets does not play a critical role in defining the possibility of an increase in the financial leverage because it is always possible to select a set of terms at which the debt financing will be raised.

If we consider these two factors together, we may make a more general conclusion that Polish corporations take decisions on changes of financial leverage on the basis of the company's need for additional financing, and not on the company's ability to have a debt load with little risk and effective efficiency.

At this stage, we will examine regression models in order to compare FE and RE regressions to the new set of variables. Then we conduct the Hausman test. As a result of this test, we find out that simplification of our model from the FE to the RE model need not impair its quality. Nevertheless, we will choose the FE model because it comprises more significant factors. However, the coefficient for the interest coverage variable remains substantially insignificant, therefore it is excluded from the final model.

We will also seek to verify our regression for heteroscedasticity and autocorrelation. To verify the first problem we apply the Wald test.

On the basis of the results of this test one can make a conclusion on presence of heteroscedasticity. Consequently, it is necessary to apply the robust estimator of the regression coefficients when building the regression.

In order to test autocorrelation, we will apply the Wooldridge test. The test showed that autocorrelation exists, though there is a 10% probability of its absence. Nevertheless, we cannot weaken its influence within this selection for two reasons. First, for the *xtreg* function, the method for the weakening of autocorrelation using just clusterisation is applied. Second, our selection is not large enough to divide it into clusters (table 2).

Table 2. The final regression for the selection of Polish companies

LEVERAGE	Coaf.	Std.Err	t	P> | t |	(95% Conf. Interval)	
1_LN_TAX_LEVEL	.0553259	.0152596	3.63	0,015	0.0160998	.094332
1_LN_CAPITAL	0.27151	.0123826	2.16	0,083	-.0051937	.0594937
1_COST_OF_ DEBT	-.0131937	.0007042	-18.74	0,000	-.015004	-.0113835
_cona	.0681903	.0933299	0.73	0,499	-.1722355	.3086173
sigma_u	.12327546					
sigma_e	.07789899					
rho	.71463785	(fraction of variance due to u_1)				

Source: calculated by the author.

Coefficient Interpretation

LN_TAX_LEVEL: The sign is positive for this variable, and as expected by the hypotheses, it accords with the opinion expressed in some previous research. It appears that the fact that a growth of paid taxes urges financial directors to increase financial leverage for the purpose of saving on tax expenditure is applicable to Polish companies.

LN_CAPITAL: This sign is positive for this variable, and this accords with the assumptions made before conducting the analysis. This accounts for the fact that companies with high capitalisation feel more confident in the capital market and it is easier for them to come to an agreement concerning favourable terms of debt raising. As a consequence, their financial leverage is bigger.

COST_OF_DEBT: The sign is negative for this variable, and this accords with our hypotheses that the more expensive the raising of debt capital, the less benefit available from its use in the form of a "tax shield" and additional benefit from high income projects in which such debt capital could be invested.

Czech Companies

The construction of each separate regression is shown in Appendix 5. See below for a summary table of regression coefficients indicating the level of significance of each of them. Construction of the between-regression in this case yielded the most significant results. Therefore, we will first find out which of the three rest models best describes the Czech model of the financial leverage formation, and then we will compare it to the between-model.

In order to compare FE and pooled-models it is sufficient to consider the results of F-test conducted after building the FE-regression. As long as this hypothesis is rejected, we have to opt out of the pooled-model in favour of the FE-model.

The Breusch-Pagan test indicates that the RE model is superior with regard to the accuracy of obtained results compared to the FE model. In this case, it is not important which model is better: the pooled or the RE model. As a result of this test we find that if we choose RE model, the quality of the results will go down, and therefore we should choose FE model.

When we find out that the quality of the FE model surpasses the pooled and RE models, we should compare it to the between-model to define the one which best describes the regularity which governs formation of capital structure of Czech corporations. Unfortunately, there is no test which would verify unequivocally which model (between- or FE) is better in terms of quality. That is why we will choose the model in which the significance of coefficients is higher, i.e. the between-model.

Next, we will exclude insignificant regressors from the list of regressors (in particular, ROA). It is impossible to verify our regression for heteroscedasticity due to the absence of software packages which assist in conducting such analyses on between-models. In order to test autocorrelation, we will apply the Wooldridge test. The test indicates that autocorrelation exists. Nevertheless, we cannot weaken its influence within this selection for two reasons. First, for the *xtreg* function, the method of the weakening of autocorrelation using just clusterisation is applied. Second, our selection is not large enough to divide it into clusters.

The final regression for the selection of Czech companies is presented in Table 3.

Table 3. The final regression for the selection of Czech companies

LEVERAGE	Coaf.	Std.Err	t	P> | t |	(95% Conf. Interval)	
1_LN_TAX_LEVEL	2.765464	.9243151	2.99	0,04	.1991539	5.331774
1_LN_CAPITAL	-.9426263	.4359327	-2.16	0,097	-2.15297	.267717
1_INT_COVERAGE	0.131958	.0063441	2.8	0,106	-.0044183	0.308098
1_TANGIBILITY	.0311059	.0087257	5.86	0,004	.0268795	.0753323
1_COST_OF_ DEBT	-32.38042	13.39622	-2.43	0,072	-69.77429	4.613453
_cona	14.44437	3.588116	4.3	0,016	4.482368	24.40678

Source: calculated by the author.

Coefficient Interpretation

LN_TAX_LEVEL: The sign is positive for this variable, as expected by the hypotheses, and this accords with some existing research. Thus, the fact that a growth of paid taxes urges financial directors to increase the financial leverage for the purpose of saving on tax expenditure is applicable to Russian companies

LN_CAPITAL: The sign is negative for this variable, and it does not accord with the assumptions made before the analysis. However, this may be accounted for by the fact that companies with high capitalisation have fewer prospects for investment, and therefore they do not need to raise debt capital for any unexpected projects. Such companies calculate all other expenses beforehand, relying on their own money flows.

INT_COVERAGE: The coefficient significance at interest coverage is at the bordering-significance level (error probability 0.106). Nevertheless, this parameter was not excluded from the regression. The sign for this variable agreed with the sign expected in accordance with the hypothesis. This may be explained as follows: if a company has a very high level of interest coverage, it has an opportunity to pay for the use of a higher financial leverage with little risk.

TANGIBILITY: The sign is positive for this regressor, and this accords with the assumptions made before conducting the data analysis. Thus, the companies with a bigger amount of fixed assets in their balance can afford to use a higher level of financial leverage.

COST_OF_DEBT: The sign is negative for this variable, and accords with our hypotheses that the more expensive the raising of debt capital, the less the benefit gleaned from its use in the form of a "tax shield", and the less additional benefit gleaned from high income projects in which such debt capital could be invested.

Conclusions

In this article, we conducted study into the influence of corporate taxation on the financial leverage of large companies in Russia, Poland and Czech Republic. Each of the three countries was studied separately. As a result, we discovered that the effective tax rate of corporate taxation exercises a decisive influence on the choice of a certain level of financial leverage.

In order to verify this idea, we defined a set of determinants which were included in the models of choice of the capital structure of each studied country. Then, these determinants were tested along with the effective taxation level.

Our first result established that the effective tax rate is a significant factor in the models of formation of the capital structure of large companies in Russia, Poland and Czech Republic. It was also found that the effective tax rate is the most important factor in the models of formation of the capital structure of large companiesin Russia, Poland and Czech Republic. This result may be accounted for by the fact that we have not included in our model the factor which could have been more significant than the level of the effective tax rate. Verification of this theory could be illustrated in the form of a trend which would have improved the present paper.

This article established that the capital structure of large companies in Russia, Poland and Czech Republic are dependent on the level of corporate taxation in each country, and defined a set of additional determinants for the models of choice of the capital structure for each of these countries. We consider that the primary result of this paper is an advance in understanding of specific aspects of influence of the corporate taxation on the capital structure of companies in Russia, Poland and Czech Republic.

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Capital Structure of Innovative Companies in BRICS Countries

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Capital Structure of Innovative Companies in BRICS Countries

Abstract

This article aims to identify the main business and economic determinants of capital structure in a sample of innovative companies from BRICS countries.

We achieve this by presenting a comparative analysis of 1,437 high-tech and 1,485 non-innovative companies in the pharmaceuticals, electronics, IT, and telecommunications sectors between 2008 and 2015. We conduct a regression analysis using a significant number of variables, such as profitability, size, proportion of tangible assets, and growth potential. The highlighted parameters are then examined in order to identify the characteristic features displayed in the capital structure of innovative firms.

Our results indicate that the following company characteristics are relevant in determining capital structure: information asymmetry costs (those which are associated with the unique activities of innovative companies), high growth potential generated by the availability of network effects, a high innovative applicability, low marginal and transport costs, and a high proportion of intangible assets. Moreover, we found that there is a distinct difference in the capital structure of companies as they vary in levels of innovation. An innovative company's proportion of intangible assets has a multidirectional effect on the debt amount. The potential for growth is also a significant factor which has a predominantly negative effect on the level of an innovative company's financial leverage. Levels of borrowing are overall lower for innovative firms.

Our major conclusion, drawing from the results above, is that innovative companies in BRICS countries use relatively little debt in the case of high growth potential. This indicates a general need to overcome the information asymmetry challenge in order to increase the growth rates of individual companies.

The scientific novelty of this analysis relates most strongly to the broadness of scope of our investigation, the focus on BRICS countries specifically, and the applicability of its conclusions in wider business and economic contexts. The breadth of data from a wide range of companies and sectors (both innovative and non-innovative), and the high number of companies utilized in the study, lend our evaluation an undeniable credibility within its scope, especially where it upholds similar conclusions in related literature of narrower focus. As a corollary to this, it may be conceivably asserted that these results are not merely applicable to individual companies, or even sectors of the economy, but due to their wide field of origin, they can have economy-wide implications on business and financial strategies.

Key terms: innovative companies, capital structure, pecking order theory, trade-off theory, sectoral specificities of companies, growth potential, intangible assets, equity and debt capital

JEL classification: G30, G32

Introduction

The 21st century economy is based on knowledge, and information has become a priority. It is safe to say that currently, knowledge in all its forms plays the most essential role in the process of economic development. Those countries which are capable of creating and effectively applying various kinds of knowledge have great potential for development, and companies that effectively and widely use new knowledge are a step ahead of their competitors.

Innovation is a manifestation of new knowledge. At the macro level, innovations are a major factor in a country's economic growth. At the micro level, innovations allow companies to increase their performance and produce new products and services through the application of new technologies, materials and processes. However, it is difficult to assess the significance of innovations at the macro level without taking into account their role at the micro level of companies, as they also play a significant role in influencing the performance of firms.

One of these performance indicators is the company's capital structure — the debt-to-equity ratio in the cost of its capital. The capital structure is one of the key performance indicators of the company, as it allows evaluation of the current state of the company, its financial stability and future development prospects. In turn, a study of the capital structure determinants allows us to understand how a company makes a decision about debt formation, i.e. how a company controls its amount of debt.

The purpose of this paper is to investigate whether more innovative firms make different financing choices compared to less innovative firms. While there are already some contributions in the literature examining the ways in which innovative firms are distinctive in various aspects of their organization (for EU and US data in particular), the uniqueness of our study is that we perform this research on a sample of BRICS countries data. We provide evidence on innovation and financial structure from a panel of BRICS companies over the period 2008–2015 and add to the empirical literature on the nature of financial choices made by high-tech or innovative firms.

Literature review

Once the foundations of the capital structure theory were laid, a number of authors adopted an approach of testing the relevance of the pecking order and trade-off theories on real data at the national and international levels. Arguably the most significant research of this sort is the work by G.R. Rajan and L. Zingales [1], in which the authors conduct a comparative analysis of companies from G-7 countries. The authors come to the conclusion that it is difficult to determine in developed markets which of the capital structure theories provides a better reflection of the companies' behavior, since the prerequisites of both theories partially manifest themselves in the real data and do not contradict each other. Similar results were obtained individually for the United States [2], the UK [3], as well as for several developing countries [4].

Some authors came to more definite conclusions, in confirming the validity only of the pecking order theory in countries such as India [5] and Spain [6]. Conversely, some studies confirmed the trade-off theory for companies in Turkey [7] and South Africa [8].

Another area in which the capital structure theory has developed is the study of sectoral specificities of companies that may affect the level of a firm's debt. One of the first of such first studies is the work by M. Bradley et al. [9] which studies the average debt level of 851 American companies over a 20-year period (and where the companies sample is divided into 25 different industries). The authors conclude that sectoral affiliation is a significant factor, which explains about 54% of the differences in the debt level among companies.

M. Talberg et al. [10] directly test the hypothesis on the relevance of a company's sectoral affiliation for the debt-to-equity ratio. Through a general regression analysis of all industries, and further study of each industry separately, the authors have come to the conclusion that this division is justified. In doing so, they confirm the need to take into account the sectoral affiliation of the company when studying its capital structure. However, the 2008 study also provided some equally relevant conclusions for the present article. First, M. Talberg et al. noted that companies affiliated with the IT sector have a lower level of debt than other firms under study from industries such as construction, food and drink production, etc. Second, individual regression for IT companies has the lowest explanatory power (the lowest R2) among all industries, while being high at the 1% interval. The authors clarify that this result may be associated with a relatively large share of "emissions" among IT companies, but at the same time it may mean that the basic model used in the article does not adequately reflect the specifics of the activities of these companies compared to firms from other sectors.

The information technology sector traditionally belongs to innovative industries. In view of the meaningful role of innovation in the modern economy, it is necessary to conduct a more thorough analysis of high-tech[1] companies in order to address the issue of the significance of the differences in their capital structure with firms from other sectors of the economy.

To carry out such analysis, it is necessary to identify the principal features of innovative companies that distinguish them from other firms, which, in turn, is impossible without an understanding of the very concept of "innovation". The contemporary approach to the concept is given in the "Guidelines for Collecting and Interpreting Data on Innovation", (otherwise known as 'the Oslo Manual'), a methodological document of the Organization for Economic Cooperation and Development (OECD)

[1] Hereinafter the words "innovative" and "high-tech" are used interchangeably

adopted in 1997. This document categorizes innovations into products and processes, as well as by the extent of innovativeness of changes in each case.

Thus, it may be concluded that an innovative company is a company that regularly (at least once every three years [11]) carries out one or several innovative activities, and it is important to note that the result of these activities should be economically significant. This means that innovation must be introduced into production or commercialized in some way. Abstract knowledge or the creation of a new product and process is not seen as an innovation before it is embedded in the production process of a company. Therefore, innovation must be inextricably linked with the main activity of an innovative company.

It is necessary to determine the features of innovative companies that may affect the equity-to-debt ratio. To accomplish this task, we make reference to previous studies which focus on the capital structure of firms in the innovation sector.

One of the first studies aimed at studying the capital structure of innovative firms was based on the sampling of small non-public IT companies in Ireland [12]. The authors state that one of the most significant features of small innovative companies is that they are characterized by the information asymmetry challenge, which arises for several reasons. First, due to the very essence of innovative activities aimed at creating new or improving existing products and processes, people directly involved in the company's work (and who are aware of the features of its activities) possess an understanding regarding the future success of certain innovation projects that the company is working on. For external market participants, and investors in particular, the question of the potential of a company can go unanswered, because the market may not have analogues of the innovation being developed. Therefore, an objective assessment of the innovative company's capabilities by an external investor appears to be difficult. Second, for small companies there is often insignificant public information, both of a financial and non-financial nature, which also turns them into a kind of "black box". Both of these reasons lead to the fact that, without sufficient understanding of the peculiarities of an innovative firm's activity, it is difficult for investors (particularly banks), to identify which projects are attractive investments and which do not have high potential. This has led to situations where, if faced with the need for external finance, small innovative companies have to pay higher loan rates as compensation to the bank for the risk. The alternative is that they will not to receive outside support at all if bank estimates of the adverse selection costs are too high.

In their work, T. Hogan and E. Hutson argue that the feature of innovative companies noted by them has a certain impact on the capital structure of these firms. High levels of borrowed capital, or the total lack of opportunities to attract capital, leads to a situation where small innovative companies have to finance their activities primarily from their own resources, and their debt has remained low. Furthermore, the authors state that this conclusion is more consistent with the pecking order theory than the trade-off theory, because the costs of information asymmetry force innovative firms to rank the sources of funding for their activities by the criterion of accessibility, thus disregarding the costs or benefits associated with the formation of an additional debt unit.

The study based on data about small companies in Finland [13] also proves that firms operating in the information and communication technology sector have lows levels of debt. Moreover, the authors of this work include in their analysis the expenses of companies for research and development (R&D) which they consider to be the most important indication that the company is systematically engaged in innovative activities. They argue that R&D expenses generate high growth potential of tech companies, because the more money that is invested in developing a new product or improving the existing one, the higher the probability will be of successful market entry in the future. Moreover, there are certain factors that are particularly acute in the areas of information and communication technologies which enhance the impact of growth potential on the capital structure of companies. These include:

- network effects (externalities) availability in the sector – which means that each new user of a product or service is capable of positively influencingthe usefulness of other users. Thus, for example, each new user of the telephone network or the Internet increases the value of other subscribers, as their opportunities to communicate with other people expand. If such a network effect "works" for a certain innovation, then the growth potential of the company increases dramatically;
- high applicability of innovations, which arises due the fact that the bulk of innovations in the information and telecommunication technology sector are aimed at improving the products used in their respective industries [14];
- the availability of fixed costs of entry into a number of areas of the information and telecommunication technology sector, as well as a low level of marginal and "transport" costs due to the nature of the product itself.

However, the theory says that growth potential negatively affects the level of a company's debt due to the fact that it is intrinsically linked to the costs of underinvestment [15; 16]. These costs mean that a company that highly evaluates its development opportunities will tend to borrow less since, all other things being equal, with debt liabilities, it will cost less in the future than in a situation where the debt is zero. Therefore, we can conclude that due to the nature of their activities innovative companies have high growth potential which, in turn, reduces the motivation to use debt instruments.

The next specific feature of high-tech firms is that the intangible part in the structure of their assets amounts to a

larger share than in non-innovative companies [17]. This feature also negatively affects the capability of innovative companies to raise borrowed capital for the following reasons. First, intangible assets very rarely act as debt security. This is primarily due to their uniqueness since, for instance, a new invention, patent or special software may have no analogues on the market or be relevant only for the purposes of a particular company, and therefore the intangible asset value may be undetermined. Second, the same feature of uniqueness in the face of financial difficulties contributes to a faster loss by an intangible asset of its value which increases the expected bankruptcy costs [18]. Third, intangible assets in high-tech companies may also appear in the form of knowledge contained in the human capital of the company's employees [19]. This means that in the situation where an employee resigns or leaves the company, the firm may face serious challenges.

All of the above works note the following: the innovative activity of companies can lead to the fact that their debt level will be low due to the information asymmetry costs, high growth potential and a specific structure of assets. However, some studies have obverse arguments. Thus, E. Bartoloni [20] states that the need for external funding of the company's activities increases in line with the extent of innovation activity, and this conclusion remains relevant regardless of the company size. It has also been proven that for fast-growing companies, the problem of inadequate revenues to finance and maintain their development is an urgent one [21]. Consequently, it is impossible to state unequivocally how the features of innovative companies influence their capital structure.

It should be noted once again that the above works on the capital structure of innovative companies [12; 13] focused on the study of small companies, but they have not studied public firms. This is notable, as in most cases public companies have great financial potential in terms of investing in the development and improvement of products, processes and technologies, and therefore play an important role in the process of generating innovations. This gap is filled with the work by P. Castro and M. Tascón [22], who study the capital structure of public European companies. The authors argue that the information asymmetry challenge, which is vividly manifested for small companies, also directly influences the position in the debt capital market of listed firms, despite their obviously greater openness and transparency for market participants. The distinctive feature of their study is also the fact that the work provides a comparison of the debt levels in high-tech and non-innovative firms at different stages of the life cycle. This approach suggests that innovative companies have a lower level of debt, and this observation is true at all stages of the company life cycle. Furthermore, the authors of the work confirm the hypothesis that growth potential is a significant factor influencing the level of the company's debt. The nature of the influence of a range of other explanatory variables shows that the behavior of innovative companies is more consistent with the pecking order theory, which also coincides with most previous studies.

And finally, another work dealing with the data of UK public companies reveals a non-linear relationship between the firm's innovative activity (measured as R&D expenses) and its debt level [23]. The authors of this article argue that the companies which have positive R&D costs use more borrowed capital than companies with a 'zero' level of these costs. As for firms with positive R&D costs, the volume of their borrowing decreases with the growth of this cost item. The findings obtained in the work may indicate that public high-tech companies use more borrowed funds than non-innovative firms. In turn, the higher the level of a company's innovative activity, the lower the level of borrowings it exhibits. This conclusion, on the one hand, supports the results of those studies concerning the negative relationship between innovation activity and debt. On the other hand, it contradicts the arguments of other authors that innovative companies have less borrowed capital. It follows that in the literature there is no unambiguous understanding of the relationship between innovation activity and debt, especially for developing countries' markets.

Thus, based on the results of various works focused on the study of the capital structure of innovative companies, a number of hypotheses can be made that will be tested in the future.

The process of choosing the capital structure for innovative companies in the BRICS countries is significantly different from the process of choosing the capital structure for non-innovative companies.

The debt level of innovative companies in the BRICS countries is lower than in non-innovative companies.

The decision regarding the determination of the capital structure of innovative companies is more consistent with the pecking order theory than the trade-off theory.

The proportion of intangible assets and the growth potential of the company adversely affect the level of borrowed capital.

Methodology of the Study

The most common approach to determine the innovativeness of a company is the sectoral characteristic. So, J. Francis and K. Schipper [24] define the following four sectors as innovative: information technologies, electronics, pharmaceuticals and telecommunications, asserting that in these industries intangible assets play the greatest role, and the nature of their activities can be considered innovative. The authors use the SIC standard industrial classification which assigns a three-digit code to each industry. It is on the basis of this system of codes that the final determination of the innovative nature of the activities of a company takes place. It should also be noted that the authors use a similar approach to determining low-tech companies, which is necessary in the course of their research. This decision regarding the high-tech status of the company as a sectoral affiliation has been developed in the works of other authors who have made the selec-

tion of industries under SIC in more detail, expanding the list of industries in which companies fit the definition of innovative companies [22; 25].

The present article has applied this particular second method of selecting innovative companies. Such decision is, firstly, due to the availability of a number of described shortcomings of the first method, which may lead to the inclusion in the analysis of companies that are not innovative in nature or, conversely, the disregarding of those high-tech firms whose reports do not provide information on the R&D costs. Secondly, the selection of innovative companies based on the standard industrial classification appears to be more uniform and simple to use. Furthermore, it is used by a number of authors, and also does not contradict other research studying the behavior of high-tech companies.

Thus, the analysis includes public BRICS companies affiliated with the following sectors: pharmaceuticals, electronics, information technology, and telecommunications. More detailed information on the SIC-codes included in the review is provided in Appendix 1.

It is also notable that, for research purposes, there is a need for sampling of companies from non-high-tech industries. The criterion for their sampling is similarly formed on the basis of the SIC-codes, and their list is taken from the work [25] and is also given in Appendix 2.

The whole study can be divided into two main stages: at the first stage, the analysis of differences in the capital structure between two samples consisting of innovative and non-technological companies was carried out. This step is necessary to test hypotheses 1 and 2, since it is at this stage that it will be determined whether it is possible to describe the process of capital structure formation by companies different in the degree of innovativeness by one regression model, or if the models should differ for various firms. At the second stage, the model will be increasingly complicated in order to study the capital structure of innovative companies more closely. At this stage, the remaining two hypotheses will be tested and conclusions will be made regarding the effect of various determinants on the debt level in high-tech companies.

We are going to take a detailed look at each stage of the study, and to start with, we describe the basic model which will serve as the basis for the entire regression analysis. This model was formulated by G.R. Rajan and L. Zingales in 1995 [1] when they studied the differences in capital structure between companies in G-7 countries. The model which will be described later is used in this article's analysis for several reasons. First, it is used as the basis in most studies focused on the analysis of companies' capital structure, regardless of sectoral, national, or other characteristics. This is because the determinants included in the model reflect the key characteristics of the company that affect its debt level, so most of the coefficients are significant in any study. Second, this model reflects universal characteristics essential for any company, such as size, profitability, etc., thereby ensuring the applicability of the model for samples consisting of various companies, and making it possible to compare these samples with each other.

The dependent variable in the described model is the ratio of the value of the company's borrowed capital to its equity. Equity capital is calculated in two forms – as a market and balance value. This approach to the definition of the explanatory variable is maintained in all such studies, the varieties of debt just change (for instance, long-term and short-term). Turning to the studies already considered in the literature review, some authors use in the analysis the ratio of long-term debt to the book value of assets [22], while others use the total liabilities while maintaining the balance sheet approach to determining equity capital [13; 23]. Based on this, we will focus on using the ratio of total liabilities to the book value of the company's assets (Leverage) as a dependent variable.

Herewith we will examine the set of explanatory variables of the basic model which are also defined as determinants of the capital structure, and which justify expectations regarding the influence of these factors on the size of the company's debt.

Profitability of the company (*Prof*), calculated as the ratio of a company's earnings before interest and taxes (EBIT) relative to its total net assets. Capital structure theories interpret the influence of this factor on leverage in different ways. According to the pecking order theory the more profitable a company is, the larger the amount of internal resources it has to finance its activities, and the less need it has of borrowed funds, whereas the trade-off theory states that more profitable firms can borrow funds on more favorable terms and, therefore, increase debt, since the bankruptcy probability is small.

The findings of various studies regarding companies' capital structure comprise the prevailing uniformity of outlook regarding the impact of profitability on leverage, and this impact is seen to be negative. Whether it is a study of the markets of G-7 countries [1], Russia [26], China [27] or India [4], the effect of the variable always remains significant and negative. In the case of innovative companies, it can be assumed that the effect predicted by the trade-off theory will be less significant than the information asymmetry challenge. Therefore, it can also be assumed that the negative effect of this variable on the debt level will also be less significant. Note that this assumption is supported by the findings of the fundamental work on the theme.

Size of the company (*Size*). There are two main approaches to the calculation of this variable. First, it can be calculated as the natural logarithm of the total assets value [22], and second, as the natural logarithm of the amount of the sales proceeds [1]. In this article, the choice has been made in favor of the second method, since this variable shows more stable and significant results in the regression analysis (which is given below).

Based on the theory, it is difficult to clearly assume the nature of the impact of the company's size on the level of its debt.

Table 1. Directions of the core variables effect

Variable	Value	Pecking order theory	Trade-off theory	Expected effect
Prof	Profitability	–	+	–
Size	Company's size	–	+	+/–
Tang	Proportion of tangible assets	–	+	+
MtB	Market-to-book value	+/–	–	–

Source: drafted by the author.

On the one hand, the size of a firm may act as a reverse proxy variable for the bankruptcy probability, thereby predicting a positive impact on the amount of borrowings. On the other hand, assuming that a larger company has more accumulated assets, it can be suggested that it will tend to use its own equity.

The two hypotheses proffered above are supported by various studies of the capital structure of high-tech companies, where the coefficient value with the variable depends on the model specification [20] or the company's life cycle [22].

Tangible assets (Tang) is the ratio of the PP&E book value to the total assets of the company. The variable reflects the proportion of tangible assets in the company and is the inverse indicator of the proportion of intangible assets. Based on the trade-off theory, it can be assumed that this ratio will have a positive effect on the debt level, because tangible assets can serve as collateral for the loan and, furthermore, their cost is more stable over time, in contrast to intangible assets. The pecking order theory, on the contrary, predicts that with an increase in intangible assets, the need for their funding grows, and due to the high information asymmetry, the use of equity capital can be extremely costly [28]. In general, taking into account the specifics of innovative companies, it can be suggested that any significant expansion in PP&E will have a positive effect on the company's sustainability in the minds of borrowers, thereby contributing to an increase in borrowing.

The company's market-to-book ratio (MtB) is a variable that is recognized in the literature as a proxy for the company's growth potential, and therefore, based on the findings of the special growth potential significance for the innovation sector, the negative relationship between the factor and the debt level is assumed.

The overall conclusions regarding the expected effect of the basic model factors are given in Table 1.

The objective of the first stage of the study is to identify differences in the capital structure of non-innovative and high-tech companies. For these purposes, in addition to analyzing descriptive statistics, first, a dummy variable (TechDummy) will be applied which is responsible for representing a company's affiliation with the innovation sector. The significance of this variable will make it possible to note that the innovativeness of the sector is indeed an important factor in explaining the company's capital structure. Second, a separate analysis will be carried out for innovative and non-innovative companies, and then the Chow test (in line with the approach used by P. Castro and M. Tascón [22]) will be conducted, which will make it possible to determine whether it is necessary to describe these companies separately, or whether in fact differences in the influence of key determinants of capital structure between companies are insignificant. Thus, the regression in the first stage of the study is presented as follows:

$$\text{Leverage} = \beta_0 + \beta_1 \cdot \text{Prof} + \beta_2 \cdot \text{Size} + \\ + \beta_3 \cdot \text{Tang} + \beta_4 \cdot \text{MtB} + \beta_5 \cdot \text{TechDummy} + \varepsilon_{it}.$$

Methodology for Analysis of the features of the Features of Innovative Companies

The second stage of the study is focused on more detailed examination of the determinants of the capital structure of only innovative companies. To perform a detailed analysis, it is necessary to expand the list of variables used in the regression, some of which will complement the standard set of factors commonly taken into account in studying the capital structure, while others reflect the features of particularly innovative companies.

The first supplementary variable is the lagged profitability value, which is one year behind (LProf). It is assumed that a potential borrower is able to form his opinion on the financial stability of a company based on previous indicators of its profitability, because the higher this parameter is, the lower the expected bankruptcy probability. In this regard, a positive relationship is expected between the lagged profitability value and the level of the company's debt.

The next variable is a non-debt tax shield (NDTS) value which is calculated as the ratio of the value of depreciation to the company's total assets [2]. The meaning of this variable is that any company charging depreciation on its PP&E reduces the size of the taxable base by the amount of these charges. For that reason, a so-called non-debt tax shield arises, which in this case arises for a reason unrelated to the payment of interest on loans. It can be assumed that the larger the non-debt shield value, the less incentives to form a debt a company will have, because the benefits of a debt shield are replaced by those of a non-debt one.

In their work, S. Titman and R. Wessel [2] argue on the shortcomings of this indicator, indicating that it may not take into account the intangible part of the compa-

ny's assets. Since this article deals with the behavior of innovative companies, firstly, the amortization amount is calculated as the sum of deductions for both types of assets, and secondly, after P. Castro and M. Tascón [22], it is necessary to include into the analysis a separate variable calculated as the ratio of the intangible assets amortization to the total amount of amortization charges (IntAmort). This determinant will make it possible to consider the impact of intangible assets on the capital structure of innovative companies from the opposite perspective to that of the variable responsible for the proportion of tangible assets. Based on the theoretical assumptions, the negative impact of the debt level can be suggested.

The next common variable, already mentioned in the previous discussion, reflects the tax benefits that the company receives, forming a debt (TaxSh). Such benefit arises when the firm reduces the amount of taxable income by the amount of payments on its financial liabilities. This indicator is calculated as the ratio of the profit tax value paid by a firm to its before-tax profit [26] (this, in fact, constitutes the effective tax rate). It is expected that the effect of this factor will have the opposite direction regarding the non-debt tax shield value, since by increasing the amount of borrowed capital the firm reduces the amount of obligatory tax.

In considering the challenges faced by innovative companies, it should be noted that information asymmetry is one of the most pressing and most difficult obstacle to overcome. However, there are two indicators inherent in each company which act as proxy variables for the bankruptcy probability, and, therefore, are capable of indirectly reflecting the safety of investing in a particular company. One of these indicators – the company's size – was described in detail as part of the basic model of this study, while the second indicator is the company's age (*Age*), acting as one of the criteria for the company's reputation [28] and the risk associated with it [29]. It is believed that the costs associated with the debt generation are higher for companies with lower standing [20], and therefore it can be assumed that a longer number of years of company existence will have a relatively more positive effect on its debt level. In our article, 'age' is defined as the logarithm of the difference between the observation year and the year of the company's establishment.

The block composed of the following variables represents three different approaches to describing a company's growth potential, which, as follows from theoretical assumptions, should play a significant role in describing the company's decision-making process regarding its borrowed capital value. The first variable is a part of the basic model and is the ratio of the company's capitalization to the book value of its assets. The remaining two variables will only be included in the final analysis of this analysis. One of them is the ratio of capital costs to the company's total assets (GrOpp) [2]. The goal of including this indicator into the analysis is to control the growth potential that is generated through investments not in research and development, but in PP&E which can improve production performance, product quality or increased production capacity. These improvements certainly increase the development potential of the company, but they are not directly related to its innovative activity. However, the assumption regarding the influence of this factor on leverage is entirely based on theoretical conclusions about the costs of underinvestment in the future, and therefore a negative relationship between this variable and the debt level can be assumed.

And finally, the last proxy variable for growth potential is the level of R&D expenses (RnD), which in a number of studies acts as the key indicator of the company's innovative activity. There are two main ways of calculating this indicator – as the ratio of R&D costs to sales revenue [2; 13; 23] and as the ratio of these costs to the company's asset value [22; 30]. It is difficult to substantiate in theory the correctness of using a particular method to calculate the variable, however, based on the results of the regression analysis (which is carried out at the next stage of work), it has been decided to use the ratio of R&D costs to sales revenue in the analysis, since this option of the variable appeared to be more significant.

Based on the above theoretical prerequisites, it is difficult to assume the nature of the impact of the level of R&D costs on the amount of financial liabilities of a company. Nevertheless, much of the studies reveals the negative relationship which is associated by the authors with the growth potential generated by R&D costs [13] and the intangible nature of the assets that are the product of these investments [31]. However, at the same time, other studies reveal a non-linear relationship, as in the work by [23] (the essence of non-linearity is described in the literature review). Against this background, it should be assumed that R&D expenses will contribute to reducing the company's debentures.

The last block of variables included in the analysis consists of dummy variables responsible for the company's affiliation with one of the countries from the list under examination: Brazil, Russia, India, China or South Africa. To avoid the issue of full multicollinearity, four dummy variables have been included in the model, and the fifth is taken as the base one.

This model specification will make it possible not only to assess the impact of standard factors on the capital structure of innovative companies, but also to account for their features. Furthermore, such a set of variables will allow for the determination as to whether the pecking order theory is more preferable for high-tech companies. This is because the analysis includes variables, the direction of influence of which is predicted by the theory, andthe regression analysis allows for the drawing of a conclusion as to whether the expectations coincide with the actual situation, and, therefore, whether hypothesis 3 is supported. In addition, this model specification makes it possible to formulate a conclusion regarding the influence of the growth potential and the structure of the assets of innovative companies on their debt amount, which will be a test of hypothesis 4.

Empirical Analysis of the Capital Structure of the BRICS' Innovative Companies

Information base of the study

The Capital IQ has become the base source of data on the financial performance of companies. The selection of companies was performed using the below criteria (with each company in the sample possessing all charateristics):

being a public joint-stock company, since only this type of company is required to disclose data on its activities;

- being located in one of the BRICS countries: Brazil, Russia, India, China or the Republic of South Africa;
- holding affiliation with the industry defined in accordance with the SIC coding. The full list of codes used and their respective industries are given in Appendices 1 and 2;
- having a positive value of total proceeds. The criterion has been applied with a view to excluding non-operating companies from the analysis.

As for the time frame of the study, the ten-year period from 2007 to 2016 was initially covered, but it was modified to reflect the period from 2008 to 2015, due to the fact that in 2007 there were a large number of gaps in various company performance indicators, as well as on the date of data collection, and most companies have not yet submitted their financial statements for 2016. Thus, this work covers an eight-year period, which is sufficient[2] to conduct a study of the capital structure, especially in emerging markets.

As a result of applying this list of criteria, a sample of 1437 high-tech and 1485 non-innovative companies was obtained, which was transformed into a balanced panel through the Stata 13[3] program. But then, the observations were filtered in two stages in order to improve the quality of the studied data. At the first stage, companies were excluded from consideration, for which more than half of the observations for such indicator as the book value of total assets are non-available. This step was taken due to the fact that most of the variables used in the regression analysis are normalized to the asset value, therefore the non-availability of a significant part of observations for this indicator in the company makes its consideration inappropriate At the second stage, data analysis was carried out, including consideration of the maximum and minimum values for all indicators used, as well as the value of standard deviations. The result of this analysis was the exclusion from the sample of those observations for which a significant deviation of the indicator from its average value was found, which could distort the subsequent results of the regression analysis. The outcome of these adjustments was that the number of innovative companies being studied was reduced to 939, while the number of non-innovative firms under consideration amounted to 659.

The distribution of companies by country is shown in figures 1 and 2. The figures show that the majority of companies from all sectors are concentrated in China, while the remaining countries have approximately equal shares in the sample. Of course, this distribution cannot be considered optimal, however, in other studies there is a similar disparity (for example, [22]), which is not considered by the authors as an obstacle to further analysis.

Figure 1. Distribution of innovative companies by country

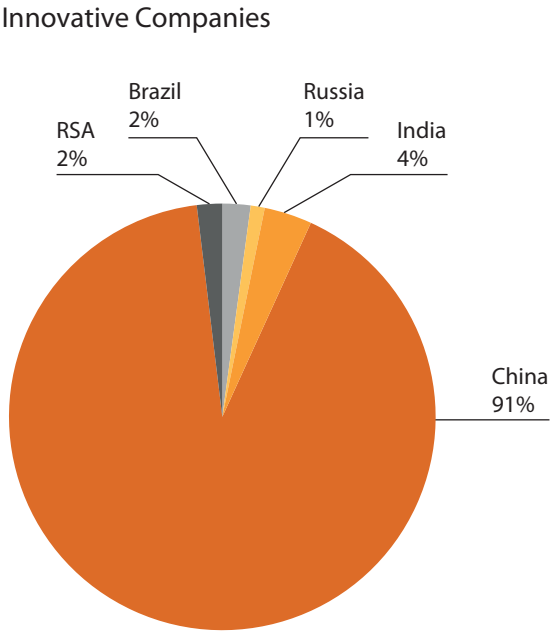
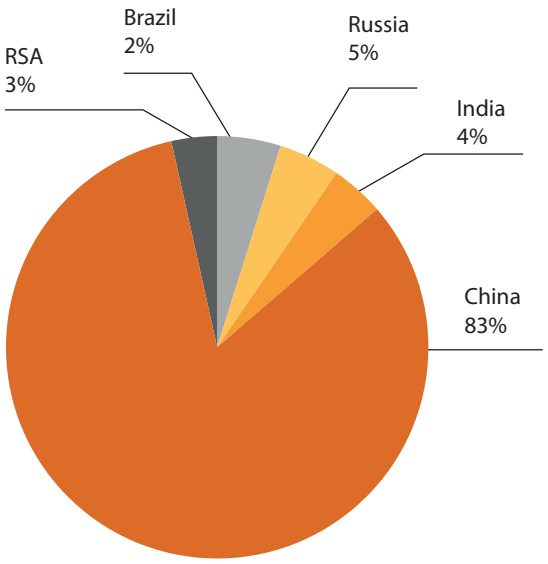


Figure 2. Distribution of non-innovative companies by country



[2] For reference, I. Ivashkovskaya and M. Solntseva [26] use the six-year period for Russia, J. Chen [27] the six-year period for China, E. Bartoloni [20] the eight-year period for Italy and P. Castro et al. [22] – the 13-year period for a number of European countries.

[3] The follow-up regression analysis will be performed using this program.

Table 2. Descriptive statistics of the core variables for innovative companies

Variable	Obs	Mean	Std. Dev.	Min	Max
Prof	6696	0,10	0,09	0,01	1,42
Size	6757	4,94	1,54	–4,13	10,88
Tang	6696	0,21	0,15	0,01	0,98
MtB	6708	15,5	29,91	0,07	299,45
Debt	6696	0,13	0,17	0,00	1,47

Source: drafted by the author.

Table 3. Descriptive statistics of the core variables for non-innovative companies

Variable	Obs	Mean	Std. Dev.	Min	Max
Prof	4782	0,08	0,07	0,01	1,86
Size	4833	5,73	1,79	–3,04	11,82
Tang	4782	0,35	0,20	0,00	0,98
MtB	4792	8,46	23,61	0,01	283,42
Debt	4782	0,24	0,18	0,00	1,74

Source: drafted by the author.

Results

An examination of these results shall commence with a comparison of the basic model for high-tech and non-innovative companies, given in Tables 2 and 3, respectively.

Based on the data given, a number of conclusions may be drawn regarding the main characteristics of companies and their differences between sectors. First, innovative companies in the sample are more profitable than non-innovative firms, although the difference in this indicator is not so significant. Second, firms from different sectors are comparable in size, although non-innovative companies are on average larger. These two indicators show that companies with different levels of innovation activity have approximately the same average profile regarding size and profitability with very similar values of standard deviations of indicators, which means that comparable companies will be compared. This, in turn, ensures the objectivity of the findings that will be further refined.

The third feature of the sample is the fact that high-tech companies have a lower proportion of tangible assets. This fact is fully consistent with the theoretical premise that innovative companies use more intangible assets in their activities. The fourth finding is that the MtB variable is on average significantly higher for innovative firms. Since this factor is one of the proxy variables for growth potential, it can be concluded that descriptive statistics supports the assumption that high-tech firms have higher development opportunities.

Having obtained an overall perspective of the nature of the data being studied, we proceed to the first stage of the study, the essence of which is to test the significance of the differences between the effects of the basic model determinants on the capital structure of companies which differ in innovativeness. To achieve this goal, a basic regression was made on data from all companies included in the sample. The Debt is a dependent variable, and all factors, the descriptive statistics of which have been considered earlier, are explanatory. Furthermore, there is a dummy variable in the regression, which takes on the value of 1 if the company is recognized as innovative, and the value of 0 if not. The results of this regression are given in Table 4.

Based on the results obtained, it can be concluded that all the coefficients of the model are significant at the 1% level, as well as the regression model itself. The significance of the dummy variable makes it possible to support the hypothesis 1, that the innovative nature of the company's activities has an effect on its debt level. To finally test this hypothesis, we make two separate regressions for high-tech and non-innovative firms (without the use of a dummy variable), and then we carry out a Chow test, which will make it possible to determine whether the differences in the models made are significant.

Table 4. The results of the basic model evaluation for three different samples

Variables	Full sample	Non-tech	Tech
Prof	−0.230***	−0.237***	−0.225***
Size	0.0186***	0.0190***	0.0180***
Tang	0.313***	0.333***	0.290***
MtB	0.000507***	0.000632***	0.000438***
Tech_dummy	−0.0477***	–	–
Constant	0.0383***	0.0282***	−0.00131
Observations	**11472**	**4776**	**6696**
R^2	**0.24**	**0.19**	**0.15**

* p<0.1; ** p<0.05; *** p<0.01.

Source: drafted by the author.

The results of this stage, shown in Table 4, indicate the following: all regressors are significant regardless of the nature of the companies under consideration, and the direction of their effect on the level of debt in the company is also maintained. However, the explanatory capacity of the regression applied to non-innovative companies is slightly higher (R^2 is 4 points higher). This result may mean that the same set of factors explains the behavior of innovative companies regarding the generation of debt with less accuracy than it explains the behavior of firms not involving innovation activities.

Now the Chow test will be implemented, taking the null hypothesis of equality of the coefficients of the two equations and on the basis that there are 4 variables in the model, and the number of observations for the group of innovative firms is 6.814 (for the rest this figure is 4.849. The result of the test is that the observed F-statistics equals to 48.82. As for the critical value, then for the 5%-point of significance it is 2.21. The observed value of F-statistics significantly exceeds the critical value, which implies that the test's null hypothesis is rejected. Based on the result obtained, it can be concluded that different samples should be described by different equations, which means that the decision-making principle regarding the generation of debt varies for companies differing in their level of innovation. This thesis suggests that hypothesis 1 of the study is thereby validated.

Now, having established that there are significant differences between the two described samples from companies with different levels of innovation, we can re-examine Tables 1 and 2, and note that the average observed level of debt of innovative firms is almost 2 times lower than the same indicator for non-innovative companies. In order to find out to what extent this difference is significant, we will perform Student's test for the equality of two means. It should be noted that the standard deviations for the Debt variable almost coincide for the two groups, therefore, it is possible to run this test. Setting the null hypothesis of equality of means, we obtain the value of t-statistics at the point of 14.25. At the same time, the critical value at the 5% point of significance is 1.96, which makes it possible to reject the null hypothesis of this test. Thus, the Student's test states that the means of debt are different for two samples. This result, in turn, allows for the conclusion that the level of debt of innovative companies is lower than in other firms, and this is a confirmation of hypothesis 2.

Summing up the findings of the first stage of the study, it can be said that hypotheses 1 and 2 were confirmed. This means that companies engaged in innovative activities make a decision on the generation of debt differently from firms for which innovative activity is not typical. Furthermore, high-tech firms have, on average, lower levels of debt than companies from other sectors.

Econometric Analysis of the Determinants of Innovative Companies' Capital Structure

The first stage of the study has shown that the structure of innovative companies is significantly different from the capital structure of other companies, and therefore a thorough and in-depth analysis of the determinants affecting the amount of debt of high-tech firms is necessary.

We are going to start the analysis with a review of descriptive statistics of supplementary factors given in the methodological part of the work. As shown in Table 5, the effective profit tax rate, acting as a proxy variable for tax benefits, is on average 18%. This value is entirely accurate, since in Brazil the profit tax rate is 30%, in Russia – 20%, in India – 30% (with a possible 20% tax deduction for R&D expenses), in China – 15% for high-tech companies, and in South Africa – 30%. Given that Chinese companies make

up most of the sample, the observed average value of the effective profit tax rate naturally increases due to higher rates in other countries. Moreover, the age of the average company for the sample is 15 and takes on a range values from 4 to 95 (the table shows the logarithm of age; the minimum value is rounded to zero by the program). This means that the companies that are completely different in the time period of the company's existence are analyzed – both entrenched market players and firms that have recently entered it. It can also be noted that the RnD variable has a slightly smaller number of observations in comparison with other determinants. This fact can be explained by the fact that many companies do not show up the R&D costs as a separate item in their financial statements.

We'll also look at the correlation matrix for independent variables given in Table 6. A number of features are included in this matrix. First, the relatively high correlation of the MtB variable with factors such as Prof and Size is indicated. This fact can be quite logically explained by the fact that, on the one hand, more profitable companies will naturally have a higher market value due to their attractiveness to market participants. On the other hand, larger companies (where size is defined as the log of sales) have a large amount of assets (the correlation of these indicators is more than 0.9), which leads to a decrease in MtB. In general, without taking into account the high correlation between the non-debt tax shield and the share of intangible asset amortization, which is natural owing to the principle of calculating variables, the low degree of interrelation between various factors can be noted.

Having made conclusions regarding the main characteristics of those determinants that will be used in the second stage of the study, we proceed directly to testing regression models. We'll start with making the Pooled model, and then compare it with more complex models with fixed and random effects.

Table 5. Descriptive statistics of supplementary variables

Variable	Obs	Mean	Std. Dev.	Min	Max
TaxSh	6693	0.18	0.12	0.00	1.00
Age	6063	2.70	0.71	0.00	4.55
RnD	5601	0.06	0.07	0.00	0.99
NDTS	6499	0.02	0.02	0.00	0.42
IntAmort	6383	0.13	0.17	0.00	1.00

Source: drafted by the author.

Table 6. Correlation matrix

	Prof	Size	Tang	MtB	TaxSh	Age	RnD	NDTS	*IntA*mort
Prof	1,00								
Size	−0,17	1,00							
Tang	−0,08	0,09	1,00						
MtB	0,45	−0,35	−0,07	1,00					
TaxSh	−0,12	0,13	0,03	−0,10	1,00				
Age	−0,23	0,27	0,05	−0,24	0,09	1,00			
RnD	−0,01	−0,24	−0,17	0,06	−0,13	−0,09	1,00		
NDTS	−0,03	0,12	0,49	−0,03	0,04	0,01	−0,03	1,00	
IntAmort	−0,14	−0,03	−0,24	−0,09	0,01	−0,02	0,15	−0,02	1,00

Source: drafted by the author.

The results of all three models are given in Table 7, however, before starting to interpret the results obtained, it is first necessary to determine which model is preferable in order to explain the choice of capital structure, and second, to test the selected model for potential issues such as multicollinearity, heteroscedasticity and autocorrelation.

To identify the most adequate model, we will run a series of tests that compare all three models in pairs with each other. We'll start with the F-test (integrated into the FE-model assessment procedure, so the result is not shown separately), the statistics for which is 11.66 with its critical value of 1.1.

Table 7. Regression models evaluation results

Variables	Pooled	FE	RE
Prof	−0.226***	−0.0799***	−0.0238
LProf	−0.0436***	−0.0109	−0.0164
Size	0.0180***	0.0340***	0.0242***
Tang	0.333***	0.226***	0.266***
MtB	0.000455***	0.000423***	0.000406***
GrOpp	−0.0112	−0.0317	−0.0248
RnD	−0.182***	0.0340	−0.0512*
TaxSh	0.0382**	0.00949	0.0103
Age	−0.00237	−0.0292***	−0.00463
NDTS	−0.368***	−0.0198	−0.0917
IntAmort	0.0212*	0.0328***	0.0255**
Constant	0.00188	−0.0331	−0.0422**
Observations	**4,120**	**4,120**	**4,120**
R^2	**0.213**	**0.174**	**0.157**

* p<0.1; ** p<0.05; *** p<0.01.

Source: drafted by the author.

This result suggests that in choosing between the Pooled model and the fixed effects model, preference is given to the second revision of the specification. To compare the Pooled model and the random effects model, we will perform a Breusch – Pagan test (Appendix 3), the test statistics of which states that the RE-model has a greater explanatory power. And finally, we'll compare the FE- and RE-models, using the Hausman test for this purpose (Appendix 4). Based on the results of this test, preference is given to the fixed effects model. The final result is that the most effective specification is a fixed effects model, while the Pooled regression is least preferred.

The next step to obtain the most optimal model is to test for various errors, the first of which may be multicollinearity. To test for this error, we'll calculate an indicator such as VIF. The results given in Table 8 suggest that the multicollinearity problem may be present in a fixed effects model, since several VIF values exceed the value of 4, which is traditionally recognised as the maximum level. However, applying the same approach to pooled regression, it can be noted that for it there is not a single VIF value above the acceptable level. Furthermore, the correlation matrix review did not reveal extremely strong connections between the variables, and therefore it can be concluded that the multicollinearity problem does not have sufficient power in the model to have a significant effect on the coefficients of various variables.

Table 8. VIF estimates

Variable	FE	Pooled
Size	6,36	1,26
Tang	5,77	2,15
GrOpp	3,18	1,56
TaxSh	3,16	1,04
Prof	3,01	1,40
NDTS	2,95	1,40
LProf	1,90	1,10
IntAmort	1,71	1,14
MtB	1,69	1,37
RnD	1,69	1,13
Mean VIF	3,14	1,33

Source: drafted by the author.

The second potential issue of the model may be the error variance dependence on the observation number or heteroscedasticity available within it. To test the assumption that this problem exists, we will run a generalized Wald test (Appendix 5). The null hypothesis of the test is that the error variance does not depend on the observation, but the test result indicates that the null hypothesis is rejected. Therefore, heteroscedasticity may be seen to exist within the fixed effects model.

Finally, a check is performed on the model for the existence of autocorrelation. In general, there are two types of autocorrelation – serial or spatial. The second (spatial) type of autocorrelation is inherent in those models where the number of years covered in the sample exceeds the number of companies. For the data studied in this article, the opposite is the case, because the number of analyzed companies is more than 100 times higher than the length of the time period. Therefore, based on the nature of the data, we assume that only serial autocorrelation may exist in the model, the essence of which is that the observational errors for one firm over different periods may be related to each other.

As such, a test will be performed on the fixed effects model for serial autocorrelation, using the Wooldridge test for this purpose (Appendix 6). Based on the test results, the null hypothesis of the absence of a link between observational errors is rejected, thus revealing the existence of autocorrelation in the model under consideration.

Thus, the result of the study of the fixed effects model is the identification of the heteroscedasticity and serial autocorrelation problems, and therefore further adjustment of the model will be made.

To perform the adjustment, the following set of tools will be applied: White standard errors (heteroscedasticity measurement), Roger's standard errors (heteroscedasticity and autocorrelation measurement), and a non-parametric covariance matrix estimation[4] (also heteroscedasticity and autocorrelation measurement). The results given in Appendix 7 indicate that, regardless of the model having been given various adjustments, the coefficients preceding all variables retain their signs and levels of significance. The result is that the original fixed effects model, given in Table 7, is applicable for the analysis of the capital structure determinants, since all the identified problems do not have a significant impact on the results of the estimates obtained. Furthermore, it is worth noting that, due to some peculiarities, for example, the availability of data gaps in the sample, the described procedures for detecting errors and making adjustments cannot be fully applied to the two other models – pooled and random effects models, and therefore we can assume that the coefficient estimates given in Table 7 are not distorted.

The potential problem of endogeneity should be also briefly discussed. Within this study, testing for the presence of such a problem is difficult due to the complexity in establishing an appropriate tool for this. However, it is worth mentioning that one of the possible causes of endogeneity may be simultaneity when it is unclear whether the explanatory variable influences the dependent variable or if there is an inverse relationship. As part of studying the capital structure of innovative companies, the following question may arise: does innovation activity affect the debt level, or, conversely, does the company make decisions on investments in research and development based on the current level of borrowing? The answer to this question is provided in the work of E. Bartoloni [20], where the Granger causality test is conducted. The result of this test is evidence of the fact that financial leverage is the dependent variable. This suggests the absence of the problem of endogeneity, which is also pertinent in the case of the present study.

Analysis of model test results

Having made a series of regression models, and also having got an idea of the role of various errors in the calculation of coefficients of the determinants under study, we will proceed directly to the analysis of the results obtained (given in Table 7).

We are going to start with the first two variables (Prof and LProf), which are responsible for the current and lag indicators of the company's profitability, respectively. The negative sign of both coefficients is maintained for all specifications of the model, and the Prof variable is significant at the 1% level in the pooled regression and fixed effects model. This result coincides with most of the previously reviewed studies and has absolute coefficient values, which are quite close to the estimates obtained, for example, in the work of P. Castro and M. Tascon [22]. The resulting sign of the variables means that more profitable companies tend to generate a smaller amount of debt. This coincides with the expected effect of the variables and supports the pecking order theory. A negative coefficient of a lagging profit indicator means that companies also tend to rely on last year's results of their activities, since this makes it possible to manage expectations about current results.

The Size variable shows a steady positive impact on the amount of debt, which corresponds to the trade-off theory. There are at least two explanations for this effect. First, larger firms are associated with a lower bankruptcy probability, and therefore borrowing costs are reduced [2]. Second, the larger the market share of the firm, the lower the information asymmetry costs associated with its activities, which also entails giving it access to more favorable loan terms. Both of these effects are particularly relevant for innovative companies, so the estimates of the coefficients of the variable are positive.

The next major variable, Tang, also has a sustained positive effect on debt levels. The obtained estimates of the

[4] Scoption in Stata 13 program.

coefficients correspond to the trade-off theory, since with an increase in the proportion of tangible assets, the loan security base grows, increasing the maximum potential amount of debt and improving the conditions for its formation. As expected, this effect will have a strong influence on innovative companies due to the fact that the level of their tangible assets is noticeably lower compared to non-technological firms.

The last variable included in the basic model is MtB, and its coefficient has a positive sign at the 1% level of significance regardless of the model specification. This result means that the growth potential, measured as the market and book value ratio of the company's capital, has a positive effect on the firm's motivation to borrow. This result is contrary to expectations, as well as to most of the work that includes a similar variable in the analysis. It can be assumed that this effect is due to the lack of internal funds in companies for financing their own growth. However, it is important to note that the influence of this factor is extremely weak with all the model specifications, so it is possible that although the effect of this factor is sustainable, it does not play an important role in the decision making process on the formation of an additional debt unit.

Let us proceed to the analysis of the coefficients of the remaining variables, the first of which is the growth potential GrOpp, measured as the ratio of capital costs to total assets. This variable has a negative effect on the leverage value, (which coincides with the assumptions of this study), but the variable is not significant. The explanation is that capital costs are the capital that companies use to acquire or upgrade various kinds of physical assets that do not play a fundamental role in the activities of innovative companies. The level of tangible assets in high-tech companies is relatively low, so the variable under review is not associated with an amount of growth potential which is sufficient to influence the amount of debt.

The RnD variable is the latest proxy to reflect the development potential of an innovative firm and, within the framework of the models under consideration, has a significant negative impact on the pooled regression and the random effects model. This effect is consistent with this study's initial assumptions, and is also supported by the conclusions of a number of works [13; 31] Hyytinen, Pajarinen, 2005]. Thus, it can be stated that the R&D costs, acting as an indicator of the company's development potential, in fact reduce the motivation to borrow due to the consequential costs of underinvestment in the future.

The effect of the tax shield (TaxSh) also coincides with the assumption made in the methodological part of this study, in that in all three model specifications this variable has a positive effect on the size of the financial leverage. It is worth noting, however, that the variable is significant only with the Pooled model at the 5% level, which indicates that the tax shield cannot be described as a crucial factor; rather, it is relegated to a minor role.

The variable responsible for the company's age (Age) shows an extremely unexpected effect, whereby the older the company becomes, the less it tends to borrow. This effect can be explained in two ways. First, age is positively correlated with the company's profitability, therefore, it can be assumed that more mature firms will need to borrow less. Second, it is probable that for the specific companies under review, the actual details of their commercial and other activities imply that lenders would be generally more afraid to loan, despite the long-term existence of the firm.

The coefficient of the non-debt tax shield (NDTS) has a negative sign, which corresponds to the assumption that the benefits from asset amortization play a significant role, reducing the motivation to use debt. This variable is especially important for innovative companies, since the PP&E depreciation amount is added to the amount of fixed assets depreciation.

The final variable examined at this stage of the study is the proportion of the intangible assets amortization in the total amortization amount (IntAmort). Despite the assumption of a negative effect, the actual coefficient has a positive sign and, moreover, it is significant for all the model specifications considered. This variable is a proxy for the level of intangible assets in the company, therefore, guided by the pecking order theory, we may assume that the identified direction of effect means that an increase in the proportion of intangible assets leads to a need for external funding. Securing intangible assets with the use of equity can be risky due to the nature of the asset category, therefore, companies may need external funds.

The final results for all significant variables are given in Table 9.

At this stage of the study, we have obtained an understanding of the role of various determinants in the formation of the company's capital structure, but this is not enough to make final conclusions. First, it is necessary to check the significance of the country factor, and, second, to test the results obtained for stability.

As described in the methodological section above, the factor of the company's location in the territory of a particular country from the BRICS list will be taken into account by including a set of dummy variables in the analysis. However, this approach faces a problem related to the need to determine the parameters of the basic variable, that is, the regression results may be sensitive to the definition of the basis. To address this problem, the following approach will be used. Five independent regressions will be performed, alternately using each country as the base variable, and the Pooled model will be used. This choice of model was made for two reasons: the best identified model – FE – does not take into account dummy variables, and although the random effects model is technically better than the pooled regression, it still has some flaws in application in such circumstances (for example, the RE-model makes the coefficient of the Prof variable insignificant).

Table 9. Significant results of the regression model evaluation.

Variables	Pooled	FE	RE
Prof	−0.226***	−0.0799***	–
LProf	−0.0436***		–
Size	0.0180***	0.0340***	0.0242***
Tang	0.333***	0.226***	0.266***
MtB	0.000455***	0.000423***	0.000406***
RnD	−0.182***	–	−0.0512*
TaxSh	0.0382**	–	–
Age	–	−0.0292***	–
NDTS	−0.368***	–	–
IntAmort	0.0212*	0.0328***	0.0255**
Constant	–	–	−0.0422**
Observations	**4,120**	**4,120**	**4,120**
R^2	**0.213**	**0.174**	**0.157**

* p<0.1; ** p<0.05; *** p<0.01.

Source: drafted by the author.

Table 10. Evaluation results of the model with country-dummy inclusion

Variables	Brazil	Russia	India	China	RSA
Prof	−0.222***	−0.222***	−0.222***	−0.222***	−0.222***
LProf	−0.0486***	−0.0486***	−0.0486***	−0.0486***	−0.0486***
Size	0.0180***	0.0180***	0.0180***	0.0180***	0.0180***
Tang	0.356***	0.356***	0.356***	0.356***	0.356***
MtB	0.000473***	0.000473***	0.000473***	0.000473***	0.000473***
GrOpp	−0.00396	−0.00396	−0.00396	−0.00396	−0.00396
RnD	−0.166***	−0.166***	−0.166***	−0.166***	−0.166***
TaxSh	0.0370**	0.0370**	0.0370**	0.0370**	0.0370**
Age	−0.00322	−0.00322	−0.00322	−0.00322	−0.00322
NDTS	−0.478***	−0.478***	−0.478***	−0.478***	−0.478***
IntAmort	0.0204*	0.0204*	0.0204*	0.0204*	0.0204*
Brazil		0.189***	0.261***	0.228***	0.189***
Russia	−0.189***		0.0715**	0.0391	−0.000520
India	−0.261***	−0.0715**		−0.0324***	−0.0720***
China	−0.228***	−0.0391	0.0324***		−0.0396*
SAR	−0.189***	0.000520	0.0720***	0.0396*	
Constant	0.226***	0.0373	−0.0342*	−0.00175	0.0379
Observations	**4120**	**4120**	**4120**	**4120**	**4120**
R^2	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**

* p<0.1; ** p<0.05; *** p<0.01.

Source: drafted by the author.

The results of the country dummy variable inclusion in the model are presented in Table 10 (the countries taken as the base are indicated at the top). Based on the obtained estimates of the coefficients, a number of conclusions can be drawn. First, the coefficients for the main variables do not change depending on the base country. Second, the values of the coefficients are slightly different from the estimates obtained earlier (see Table 7), retaining all signs and levels of significance. Third, the significance of dummy variables strongly depends on the chosen basis. These three observations suggest that the inclusion of the country factor in the model does not make sense. To verify this assumption, we have performed a test on the hypothesis of an insignificant difference from zero in the *q*-coefficients of the regression equation, where q is the number of dummies denoting countries (four), and the ordinary Pooled model will be used as an equation with restrictions. The result of the test was that the inclusion of dummy variables in the analysis was justified.

Thus, the country factor does have an effect on the capital structure of the companies under review. A more thorough analysis allows us to conclude that countries are in the following descending order regarding the strength of the positive effect on the amount of debt: Brazil, South Africa, Russia, China, India. However, at the same time, it can be noted that the effect of this factor is not too strong, because the adjustment made by the country factor only slightly changes the coefficients of the variables of the main equation.

Having developed and tested the final model, it will hereby be interpreted in terms of the implementation of the hypotheses of this article, starting with hypothesis 4, which states that the growth potential and intangible assets of the company negatively affect the value of its debt. Based on the results obtained, it can be considered that the hypothesis is only partially confirmed. On the one hand, the proxy variable for the proportion of intangible assets – IntAmort – has a steady positive effect on leverage. On the other hand, two out of the three growth potential proxies (GrOpp, RnD) have negative signs, and the only factor with a positive impact (MtB) has a very weak effect on the amount of borrowing. Thus, the part of the hypothesis regarding intangible assets is not consistent with the results obtained, while the part concerning growth potential appears to be confirmed.

As for hypothesis 3, it also cannot be unambiguously confirmed. Estimates of the coefficients of Prof, Age and IntAmort variables confirm the adhesion of the companies under review to the pecking order theory. However, estimates of Tang, Size and NDTS variables are consistent with the trade-off theory. Based on this correlation of variables, it is difficult to conclude which theory more accurately describes the behavior of innovative companies of the BRICS countries. In this regard it may be stipulated that a "classic" result has been obtained, whereby both theories play an important role. While the hypothesis has found support it has not been demonstrated obviously enough to get confirmation.

Conclusion

This article identified the main features of the capital structure of innovative companies from BRICS countries, as well as the significant determinants of that capital structure and the directions of their effect. To achieve this goal, an analysis which includes three main stages was carried out.

First, on the basis of theoretical prerequisites, as well as the work of a large number of various authors, the main features of innovative companies influencing the structure of their capital were identified. These features include the existence of the information asymmetry costs associated with the specificity and uniqueness of the activities of innovative companies, the presence of high growth potential generated by the existence of network effects, the high applicability of innovation, and the low marginal and transport costs associated with these companies. Furthermore, it was noted that intangible assets had a significantly larger proportion in the asset structure of high-tech companies than in other firms.

Second, a comparative analysis of high-tech and non-innovative companies was performed. Comparisons between them were made for parameters such as profitability, size, the proportion of tangible assets, and growth potential. The result of this analysis was that the hypothesis of the need to explain the capital structure of companies varying in their level of innovativeness with the use of different models was confirmed. Moreover, it was shown that the level of borrowing of innovative firms is at a lower level.

Finally, at the third stage, a detailed analysis was performed of innovative companies using a broad selection of variables. The results obtained at this stage of work made it possible to come to several conclusions. First, the coefficients of the estimated variables confirmed the significance of both the pecking order theory and the trade-off theory, thereby not providing an option to fully confirm one of the hypotheses of the study. Second, it was confirmed that the proportion of intangible assets in the company has a multidirectional effect on the amount of debt, which also contradicts one of the hypotheses of this paper. However, it was proven that growth potential is a significant factor which has a predominantly negative effect on the level of an innovative company's financial leverage.

The model was also tested for errors such as multicollinearity, autocorrelation, and heteroscedasticity, which showed that the results of the study were not distorted. Furthermore, with the use of dummy variables, the country factor was taken into account, which, although appearing to be significant, did not show a strong effect on the amount of companies' debt. In addition, a separate analysis was performed for companies with different levels of growth potential, which confirmed the importance of growth potential as determinants of the capital structure of innovative companies.

Finally, it should be noted that by implementing methods such as the change of the dependent variable, and a reduc-

tion in the number of companies studied, it was possible to draw positive conclusions about the sustainability of the results obtained in the study.

In general, the outcome of this article may be regarded as obtaining an understanding of those determinants that have a significant effect on the capital structure of innovative companies of the BRICS countries. The results obtained indicate that these companies use relatively little borrowed capital with high growth potential, which indicates the need to overcome the information asymmetry challenge in order to increase not only the growth rates of individual companies, but also the economy as a whole.

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Appendices

Appendix 1. SIC codes used in the study for determination of innovative companies

SIC	Industry	Number of companies
283	Drugs	238
357	Computer and office equipment	37
361	Electric transmission and distribution equipment	40
362	Electrical industrial apparatus	34
363	Household appliances	40
364	Electric lighting and wiring equipment	20
365	Household audio and video equipment and audio recordings	22
366	Communication equipment	68
367	Electronic components and accessories	172
369	Miscellaneous electrical machinery, equipment, and supplies	23
481	Telephone communications	19
737	Computer programming, data processing, and other computer related services	220
873	Research, development, and testing services	6

Appendix 2. SIC codes used in the study for determination of non-innovative companies

SIC	Industry	Number of observations
160	Heavy construction other than building construction – contractors	54
170	Construction – special trade contractors	10
202	Dairy products	13
220	Textile mill products	74
240	Lumber and wood products, except furniture	38
260	Paper and allied products	58
308	Miscellaneous plastics products	49
324	Cement, hydraulic	31
331	Steel works, blast furnaces, and rolling and finishing mills	78
356	General industrial machinery and equipment	59
371	Motor vehicles and motor vehicle equipment	120
401	Railroads	7
421	Trucking and courier services, except air	6
440	Water transportation	37
451	Air transportation, scheduled, and air courier services	13
541	Grocery stores	12

Appendix 3. Result of Breusch-Pagan test

Breusch and Pagan Lagrangian multiplier test for random effects
Debt[id,t] = Xb + u[id] + e[id,t].
Estimated results:

	Var	sd = sqrt(Var)
Debt	0,0189	0,1377
e	0,0051	0,0718
u	0,0104	0,1023

Test:Var(u) = 0
chibar2 = 0.0000
Prob > chibar2(01) = 3528.28

Appendix 4. Result of Hausman test

	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Fe	re	Difference	S.E.
Prof	-.0798754	-.0238023	.0560731	.0094013
LProf	-.0108502	-.0163607	.0055105	.0028678
Size	.0340206	.0241929	.0098277	.0025194
Tang	.2262441	.265892	-.0396479	.0106723
MtB	.0004226	.0004057	.0000168	.0000267
GrOpp	-.031733	-.0247761	-.0069569	.0046174
RnD	.0339504	-.0511698	.0851202	.0132489
TaxSh	.0094864	.0103241	-.0008377	.0017928
Age	-.0292078	-.0046254	-.0245824	.0079474
NDTS	-.0197573	-.0917329	.0719756	.0638319
IntAmort	.032816	.0254982	.0073179	.004384

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg.

Test:H0:difference in coefficients not systematic
chi2(11) =(b-B)'[(V_b-V_B)^(-1)](b-B)
=147.89
Prob>chi2 =0.0000

Appendix 5. Result of Wald test

Modified Wald test for groupwise heteroscedasticity in fixed effect regression model
H0: sigma(i)^2 = sigma^2 for all i
chi2 (734)=8.3e+33

Prob>chi2 =0.0000

Appendix 6. Result of Wooldridge test

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
F(1.673)= 2.432

Prob > F = 0.0000

Appendix 7. Results of regression adjustments

Variable	fe	fe_robust	fe_cluster	fe_scc
Prof	-.07987544***	-.07987544*	-.07987544*	-.07987544**
LProf	-.01085017	-.01085017	-.01085017	-.01085017*
Size	.03402063***	.03402063***	.03402063***	.03402063***
Tang	.22624408***	.22624408***	.22624408***	.22624408***
MtB	.00042256***	.00042256***	.00042256***	.00042256**
GrOpp	-.03173298	-.03173298	-.03173298	-.03173298
RnD	.03395039	.03395039	.03395039	.03395039
TaxSh	.00948639	.00948639	.00948639	.00948639
Age	-.02920779***	-.02920779*	-.02920779*	-.02920779***
NDTS	-.01975729	-.01975729	-.01975729	-.01975729
IntAmort	.03281604***	.03281604**	.03281604**	.03281604***
_cons	-.03311476	-.03311476	-.03311476	-.03311476

Appendix 8. Results of regressions with changed dependent variable

Variable	pool_Ltd	fe_Ltd	re_Ltd
Prof	-.02866937**	-.01752809	-.01079245
LProf	-.00052142	.00562857	.00339258
Size	.01026377***	.02048328***	.01295639***
Tang	.13363339***	.08600627***	.10683105***
MtB	.00012231**	.00012397**	.00008992**
GrOpp	.04782855**	.04367526**	.0475339***
RnD	.02562191*	.04582694**	.02077422
TaxSh	.03046298***	.01329726*	.01616565**
Age	-.00143026	-.02453392***	-.00543344*
NDTS	-.1575522***	-.09913022	-.10966824*
IntAmort	.03194014***	.02823245***	.02693099***
_cons	-.05106746***	-.03347401**	-.04804811***

Appendix 9. Results of regressions on curtailed sample

Variable	pool	fe	re
Prof	-.27531357***	.04688933*	-6.267e-06
LProf	-.0065659	-.00376311	-.00420911
Size	.01887831***	.03116822***	.02274216***
Tang	.38639663***	.21919802***	.2694406***
MtB	.00052568***	.00043115***	.00042012***
GrOpp	-.01047027	-.0537047*	-.04717004
RnD	-.22953652***	.02536948	-.0582564*
TaxSh	.02528162	.00492573	.00433938
Age	.00008496	-.02299369**	-.00050959
NDTS	-.63214473***	-.05613808	-.13884604
IntAmort	.03743833***	.03330137**	.02600231**
_cons	-.01258025	-.02455333	-.03829832**

The Impacts of Taxation on Capital Structure in BRICS Countries

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The Impacts of Taxation on Capital Structure in BRICS Countries

Abstract

Capital structure is an indicator of the value of a firm and is a key performance indicator concerning how efficiently a company operates. Debt and leverage influence a company's investment risks and influence the rate of return required by investors. Therefore, decisions affecting capital structure choice have crucial long-term effects.

The aim of this study is to determine the effects of corporate tax rates on capital structure in public nonfinancial companies based in BRICS countries. The specific object of our analysis is the evaluation of financial leverage as a proportion of debt financing based on the amount of total assets. This analysis is carried out on a sample of BRICS companies over the period from 2010 to 2015.

To conduct this research, panel data regression models are employed, including the fixed effects (FE), random effects (RE) and generalised method of moments (GMM) models. Each BRICS country is analysed separately in order to avoid biased estimates due to a host of significant country-specific differences.

The results presented herein indicate that effective tax rate is statistically significant, but the effect of taxation varies across countries. For example, effective tax rate is an important capital structure determinant, and it is significant across all countries. However in analytical terms, this investigation reveals that the most suitable regression model for the majority of BRICS countries is the fixed effects method, although for Russia the most appropriate model is the random effects method. To summarise, three separate hypotheses regarding the interplay of taxation and capital structure have

This research crucially serves to demonstrate facets of the complexity of the economic situation in the key economies of BRICS countries. The generally-supported hypothesis implies that the higher the corporate tax rate, the more tax benefits the company receives from using a tax shield. The results of this study indicate that contrary to most existing literature, effective tax rate has a negative relationship with the capital structure in Russia, India and South Africa. Moreover, various existing research studies in the field have been validated, and individual aspects of our results serve to alternatively validate the tradeoff and the pecking order theories. The conclusions presented herein regarding the complexities of the interplay between economic indicators between BRICS countries will be essential information in the commercial and academic spheres and anyone concerned with emerging economies.

Keywords: financial leverage, capital structure, tax shield, effective tax rate, return on assets, depreciation, BRICS

JEL classification: G21

Introduction

Capital structure is the key topic in corporate finance. The capital structure of a company defines the value of firm, which is the key performance indicator of how good a company operates and whether it is a good idea to invest in that specific company. Thus, managers who define the leverage of a company take on a decision with long term effects, since leverage impacts on a company's investment risks and affects the rate of return required by the investors. So, the main task is to develop an optimal financial strategy that leads to the best financial results.

Since F. Modigliani and M.H. Miller published their papers (1958, 1963) [1; 2], the tradeoff theory has become one of the central theories in capital structure decision making. This theory is based upon the tax benefits of debt. It says that companies balance the benefits of debt against the costs of financial distress. Tax effects prevail at a low level of leverage, while distress costs prevail at a high level of leverage. In turn, companies have an optimal debt ratio which exactly offsets these distress costs. However, although the effects of tax on the choice of capital structure plays a central role, there are few papers that study it. These studiesestablish a solid statistical connection between capital structure choice and taxes.

The main problem is that previous research has been made using cross sectional data, and it was necessary to wait for a significant variation in tax rates to observe the tax effect on capital structure. Relations between the financial decisions of companies and tax rates attract a lot of attention, since they play a central role in capital structure theory. The main reason for this phenonemon is that the capital structure choice can change the after tax value of cash flows of the companies. Therefore, managers who are concerned about the maximising of after tax value of their firms must optimise the firms' capital structure.

Graham (2003) [3] wrote about being "not aware of any study that documents tax-related time series effects in debt usage". Graham [3] relates further that there is a gap that consists in "the lack of time series evidence about whether firm specific changes in tax status affect debt policy". The present paper meets the aforementioned Graham's conditions and tries to eliminate the gap described above by employing a panel regression with fixed and random effects.

Literature review

Capital structure is one of the key topics in corporate finance. There is a huge amount of papers written on this subject. Since this paper is focused on the impact of tax-based aspects of debt choice, I decided to make a review of most relevant theoretical and empirical works.

All modern theories of capital structure are based on a seminal work by F. Modigliani and M.H. Miller published in 1958 [1]. In their paper, the authors concluded that in perfect market conditions it does not matter what capital structure the company uses financing its operations: whether the firm finances with debt or equity, in other words there is no difference in how the company is financed (Value firm with debt = Value firm without debt). The aforementioned assertions are based on the following key assumptions:

- no taxes;
- no bankruptcy costs;
- no effect of debt on a company's earnings before interest and taxes;
- equivalence in borrowing cost for both companies and investors;
- no transactions costs;
- symmetry of market information (meaning companies and investors possess the same information).

Of course, this set of assumptions is unrealistic in the real world. In Modigliani and Miller's 1963 [2] "correction article" (the first article where the tax benefit of debt was demonstrated), the assumption of a perfect market persisted, but corporate income taxation was considered. This consideration gave rise to the concept of the tax shield. According to the "classical" tax system model interest is deductible, and so it is paid before taxes.

$$TS = \sum_{i=0}^{n} \frac{t \times I}{(1+r)^i}$$

where:

TS – tax shield;

I – interest;

r – discount factor.

Modigliani and Miller showed that under these conditions the value of the company has a positive relation with the debt tax shield, and increases correspondingly to the debt tax shield level. The main idea of the paper proposes that the more debt a company attracts, the larger the degree of profit available to investors (equity holders and debt holders), and thus the company's value increases. Therefore, to maximise its value, the company should be financed entirely by debt. Despite the fact that the inferences of Modigliani and Miller are poorly applicable in the real world; they made a great contribution to the development of Corporate finance, in particular to the theory of capital structure.

$$V_{firm\ with\ debt} = V_{firm\ without\ debt} + t_c D,$$

where:

V – company's value;

t_c – corporate tax rate;

D – debt;

$t_c D$ – tax advantage of debt.

D. Dhaliwal, R. Trezevant, and Shiing-wu Wang (1992) [4] compared the changes in companies' investment tax shields and debt tax shields before and after the (US) Recovery Act of 1981. They discovered a substitution

effect. The authors of the research also found support for the relationship between corporate taxes and the leverage of the companies.

J.K. MacKie-Mason (1990) [5] studied the effect of taxes on corporate financing decisions. The paper clarified relationships between the tax shields and the use of debt in the studied firms. The paper showed that tax shields lower the marginal tax rate causing the firms to minimise or to have no taxable income. The obtained results support the theory that there is a positive relationship between corporate tax rates and the level of debt the firm uses to finance the operations.

D. Graham and C.R. Harvey (2001) [6] interviewed 392 chief financial executives from the US and asked them approximately 100 questions about the different indices they apply when making corporate decisions, and analysed the way these characteristics can affect the firm. Additionally, CFOs were asked about the taxation and capital structure choice, and it was found that the tax advantage of interest deductibility is a significant concern for CFOs. This finding provides some evidence that taxation is an important index in the process of defining the capital structure of firms, but the relation between taxation and capital structure depends on other characteristics such as firm size, the political and economic environment, etc.

D. Givoly and C. Hayn (1992) [7] studied the changes in corporate debt policy after the tax rates had been changed, and the effect on debt policy of the firms of the (US) Tax Reform Act of 1986. According to this act, marginal tax rates were reduced and, therefore, the use of debt by firms should be reduced. The authors found that the firms which held a high tax rate before the act was introduced, reduced their debt levels. So, this showed a positive relationship between changes in US corporate taxes and changes in corporate leverage.

J.P.H. Fan, S. Titman, and G. Twite (2012) [8] examined the interrelations between taxation, the institutional environment and capital structure. The dataset consists of nonfinancial firms from 39 developed and developing countries and it covers the period from 1991–2006. The authors found that the capital structure choice of firms is affected by the taxes in accordance with the theory, that is, when the capital gain level is positive from the use of the tax shield, the firms increase their leverage. It was also found that taxation has a positive effect on leverage in developed countries, but not in emerging economies.

R.G. Rajan and L. Zingales (1995) [9] examined the capital structure choice determinants of firms from the G-7 countries from 1987–1991. The company debt level in these countries is quite similar. It was found that those factors correlated with a firm's leverage in the US are similarly correlated in G7 countries. Also, the authors showed that taxes affect the capital structure of the firms: the use of debt is higher in countries with a higher corporate tax rate.

M. Barakat and R.P. Rao (2003) [10] tested the tax models of the theory of capital structure on the data from Arab world. The authors analysed companies that belong to nonfinancial sectors of the economies. The Arab economies can be divided into 2 parts: economies that levy corporate taxes and economies that don't. This fact gives us the possibility to test the differential impact of taxes on the choice of capital structure of firms. The authors found that in those economies which impose corporate income taxes, the companies have a relatively higher leverage than those companies operating in economies that do not have a corporate tax system. It was also documented that the effective tax rate has a significant and positive impact on financial leverage. This pushes companies with higher marginal tax rates to use more debt in order to take more advantage of the tax shield debt benefit. In taxed Arab economies no evidence was found of the impact of personal taxes on capital structure choice. Barakat and Ramesh also found that debt in Arab countries is influenced by size and profitability. Their results are similar to those of Rajan and Zingales (1995) [9], who made the analysis on the data of G7 countries and Booth et al., and who analysed the data from 10 developing countries. However, the authors of this paper also made some interesting observations; for example, they found that for Arab countries the leverage value (book value) and growth are positively related. These findings are opposite to those identified for the US and other developed countries (e.g., Rajan and Zingales (1995) [9].

F.A. Longstaff and I.A. Strebulaev (2014) [11] studied the relation between corporate tax rates and leverage using an extensive historical dataset that includes data from the financial statements of US private and public companies from 1926 to 2009. The data set consists of all corporate income tax returns filed in the US during the period. The authors analysed a much longer duration for a larger sample of companies than in any prior study. The firms were divided into 3 categories: small firms – with total assets less than $10 million, medium – with total assets between $10 and $100 million, and large – with total assets more than $100 million. The authors found a strong positive relation between taxes and capital structure. An increase in corporate leverage is caused by changes in tax rates. Studying the differences with respect to firm size, they concluded that only large companies can quickly adapt corporate leverage to changes in tax rates. Medium-sized firms indicate an increase in corporate leverage with a lag, and the corporate leverage of small firms is not related to the time series variation in tax rates. These results are consistent with the presence of financial constraints with a fixed component. The fixed component causes the lag for medium companies and makes it costly for small companies to vary their leverage in response to tax incentives.

T. Bas, G. Muradoglu and K. Phylaktis (2009) [12] analysed the determinants of capital structure decisions for 25 developing countries from different regions. Their research was conducted on a dataset from the World Bank Enterprise survey. The paper focuses on small companies, since they are large contributors to the GDP of developing countries. They analysed whether the capital structure determinants differ among firms of different size, and investigated whether the capital structure determinants differ between

private and listed firms. It was found that all firms follow the pecking order on debt financing decisions, but listed firms prefer equity financing. It was also discovered that financing decisions are not affected by internal funds, and that small and large firms follow different debt financing policies. Further results indicated that small firms have a low but growing level of debt, and as they become more diversified the risk of failure is reduced and leverage quotient can be increased. Small companies, due to asymmetry of information, have restricted access to financial resources, and therefore they have a higher interest rate cost and they are financially more risky in comparison with the large firms. These restrictions on access to finance can influence the growth of small firms. In conclusion, large listed firms have easier access to finance (international and domestic financial markets) in developing countries, but small and private firms are dependent on the state of local conditions in their countries' economies .

T. Hemmelgarn and D. Teichmann (2014) [13] analysed the influence of changes of corporate income tax rate on leverage, dividend payouts and earnings management in financial (banks) sector of the economy. A large dataset of corporate income tax reforms was selected from more than 25 countries around the world from 1997 through 2011. The results suggest that the tax changes influence all three variables: leverage, dividend payouts and earnings management, over the first 3 years after the reform was enacted. It was observed that the banks immediately reacted to corporate income tax reforms by adjusting their debt to equity ratios and dividend payouts. The income tax rate determines the value of the debt tax shield, and therefore the bank's leverage increases along with the tax rate. The higher the tax rate, the more incentives the banks have to increase debt financing, whereas the interest payments are tax deductible from the corporate income tax base. It was found that the tax effects are statistically significant. Another result was that the dividend payouts are directly related to the corporate income tax rate. This is the evidence that the banks actively use dividend payout policy as an instrument for adjusting their capital structures. Additionally, banks increase their loss loan reserves in expectation of a decline in income tax rate, because lowering the tax rate makes the losses less valuable.

A. De Socio and V. Nigro (2012) [14] studied the relationship between corporate income tax rate and leverage. Their dataset included a sample of European nonfinancial companies from 2004 to 2007.The main goal was to assess whether the debt tax shield affects decisions regarding the capital structure. In this study, they conducted a panel regression that showed a positive effect of corporate income tax on corporate leverage. The results were significant. According to the tax debt shield theory, highly profitable firms have a higher level of debt. The results are robust across different estimation methods and different proxies for the extent of financial development, and also the variations within legal systems of the countries where they are located.

J.P.H. Fan, S. Titman and G. Twite (2012) [8] examined the interrelations between taxation, institutional environment and capital structure. The dataset consists of nonfinancial firms from 39 developed and developing countries and covers the period from 1991–2006. The authors found that the capital structure choices for the firms in question are affected by the taxes in accordance with the theory: when the capital gain is positive from the use of a tax shield, firms increase their leverage. It was also found that taxation has a positive effect on leverage in developed countries, but not in emerging economies.

M.O. Nyamita, H.L. Garbharran and N. Dorasamy (2014) [15] studied the factors that influence debt financing decisions: profitability, tangibility, tax rates etc. They analysed research written by different authors and found no definite answers regarding the effect of tax rates on the capital structure of companies. However, they did discover that despite the theory that firms should increase their leverage in response to an increase of corporate tax rate (increasing the interest tax shield implies tax benefits, since debt interest payments are tax deductible), some empirical papers describe contrary results. It could appear this way because of various factors: the economic environment of a country, the size of a company etc. Nevertheless, the authors concluded that according to empirical studies there is a negative relationship between the corporate tax rate and the leverage of the firm.

S. Barrios, H. Huizinga, L. Laeven and G. Nicodème (2012) [16] provided evidence for the implications of international taxation on the organisational structure of multinational companies. They used a panel data of multinational companies from 33 European companies from 1999 to 2003 in their analyses. One of the main results made by these authors was that local tax rates have a positive impact on the financial leverage of companies.

R.H. Gordon (2010) [17] studied the impact of taxation on corporate use of debt. The dataset consisted of companies from the United States. This research found evidence for the tradeoff theory and showed that in large profitable companies the use of debt is encouraged by taxes. Companies' corporate tax liabilities fall because of interest deduction, when the companies borrow money. Thus, debt financing is subsidised by the tax law to the extent that the resulting extra taxes paid on this interest income are less than the drop in corporate tax liability.

Y. Chen and N. Gong (2011) [18] offered a new method to test the tradeoff theory (firms should increase their leverage to capture tax benefits so that the marginal tax benefits are equal to the marginal costs of debt). In this situation, the corporate tax rate rises and the companies' market value declines. As such, the firm may want to increase its leverage to increase the tax shields, although having declined market value, the company has financial constraints. Consequently, the leverage may initially increase and then decrease as the tax rate rises. There was found empirical support for the nonlinear relationship between the leverage and marginal tax rate.

T. Hartmann-Wendels, I. Stein and A. Stöter (2012) [19] in their study provided the evidence of the impact of taxes

on capital structure choice. This study analysed a dataset that consisted of 80,173 German nonfinancial companies from 1973 to 2008. They simulated the marginal tax rate for firms using Graham methodology. It was found that German companies are encouraged to change their capital structure, and to increase the leverage according to the deductibility allowance of interest payments in Germany. The authors showed that there is a positive and significant relationship between the leverage of the company and the marginal tax benefit of debt: an increase of marginal tax benefits of 10% causes a 1.5% increase of the debt ratio.

W. Kim and H.-J. Lee (2015) [20] studied how foreign and domestic subsidiaries and wholly-owned by individuals firms operate under Korean tax law. The difference consists in the fact that foreign subsidiaries operate under the classical tax system where double taxation of personal and corporate income provides an interest tax shield, but domestic subsidiaries are under an imputation tax system, whereby the preference of debt usage is largely eliminated. The dataset consists of non-financial wholly-owned subsidiaries (where a single major shareholder holds 100% of shares as of the end of 2010). Once the firms were selected for study, they were divided into 3 groups: foreign firms' subsidiaries, domestic firms' subsidiaries and Korean firms wholly-owned by individuals. In total, the dataset included 474 foreign subsidiaries, 684 domestic subsidiaries and 855 wholly-owned firms, (in total 2013 wholly-owned subsidiaries). Next, annual financial information for these firms from 2005–2010 was analysed. It was found that there are no significant differences in the amount of total leverage across the 3 structural categories of companies: the tax benefits don't have a first order influence on the overall leverage; and foreign subsidiaries exhibit substantially higher internal debt than domestic subsidiaries. Tax status has a first order influence on internal firms' leverage.

N. Dwenger and V. Steiner (2014) [21] studied the impact of profit taxation on the financial leverage of firms. The dataset consists of comprehensive corporate tax return data of German firms for the period 1998–2001. During this time in Germany major corporate tax reforms were introduced. A financial leverage ratio was calculated as long-term debt divided by total capital. The authors found that:

- the tax rate has a significant and relatively large positive impact on corporate leverage;
- an increase in tax rate of 1% would increase the financial leverage by 0.7%;
- the debt ratio is less responsive to tax incentives for small corporations and firms that face high economic risks, due to capital market restrictions.

R. Miniaci, M.L. Parisi and P.M. Panteghini (2014) [22] analysed the relationship between subsidiary capital structure and European taxation using a tradeoff model. Their dataset includes financial data for companies from 38 European countries (extracted from the AMADEUS database). The minimal criteria for these companies were:

- more than 15 employees;
- operating revenue of more than 1 mln USD;
- total assets more than 2 mln USD;
- limited (Ltd) or Limited Liability Company (LLC).

They concluded that an increase in the foreign country tax rate raises the subsidiary leverage:

- an increase in the parent company's tax rate reduces the tax benefits of shifting debt from the parent company to its subsidiary;
- this (parent company's) tax rate increase raises the Multinational Corporation's (MNC) overall tax rate, thereby increasing the tax benefit of interest deductibility.

M. Faccio and J. Xu (2015) [23] tried to answer the following 2 questions. First, do taxes affect corporate capital structure choice? And second- how large is their economic effect? The key contribution of their paper is the use of a multitude of shifts in statutory tax rates: both at the personal and corporate level. The dataset consists of firms from 29 OECD countries during the period from 1981 to 2009 (Database: OECD Tax database, World Bank World Development indicators). The results indicate that both personal and corporate tax rates have a statistically significant relationship with the leverage, and that the impact of tax changes on capital structure appears to be economically large.

To conclude the literature review analysis, it is necessary to state that most researchers emphasise the significant effect of tax rate on the capital structure of companies.

There are some drawbacks in the analysed literature:

- there are a lot of researchers that uses cross-sectional variation in data, but Graham (2003) [3] pointed out that this effect of tax on capital structure of the firm isn't always large, and he pointed out that there is a need for research that documents tax-related time series effects in debt usage;
- many authors who analyse the impact of taxation of many countries in one research don't make a separate analysis for each country's companies. However, I consider that countries must be analysed separately, because each of the countries has its own tax legislation (corporate tax rate etc.). So, there are not considered country differences. Analysing countries together may cause biased estimates of coefficients.

In this research, initially, I analysed the impact of the effective tax rate on the leverage of each country's companies separately and then the effects were compared to each other on the country level.

On the basis of the detailed analyses of the above literature review, the following hypotheses are proposed for this study:

H1: The effective tax rate positively relates to company leverage in BRICS countries.

Most of research in the field states that the effective tax rate positively influences the leverage of the company, since the interest on debt is tax deductible. Therefore, companies attract more debt, which implies greater benefits from the tax shield.

H2: The return on assets negatively relates to company leverage in BRICS countries.

According to the pecking order theory, more profitable companies will less use debts, and so therefore the leverage will decrease. This is supported by the paper of M. Faccio, J. Xu (2015) [23].

H3: The inflation rate positively relates to the company leverage in BRICS countries.

According to the K. Jõeveer (2013) [43] paper, inflation has a positive relation with the leverage of the company, because in periods of high inflation rates the real value of debt's tax deductions increases.

Table 1. Description of Literature Review

Name	Year	Study	Results
Modigliani, Miller [1]	1958	Perfect market conditions	It does not matter which capital structure a company uses
Modigliani, Miller [2]	1963	Perfect market conditions, it was introduced taxation	Showed the tax benefit of debt
DeAngelo, Masulis [24]	1980	The tax advantage decreases with non-debt tax shields	Firms with larger non-debt tax shields have lower leverage
Givoly, Hayn [25]	1986	After the Tax Reform Act of 1986, 10 years data	Personal taxes play an important role in capital structure decisions
Scholes et al. [26]	1990	Sample of firms in the commercial banking industry	Positive relations between tax and leverage
MacKie-Mason [5]	1990	1,747 debt and equity issues, 1977–1987	Firms with higher tax rates are more likely to issue debt
Givoly et al. [25]	1992	Result of the Tax Reform Act of 1986	Positive relation between changes in US corporate taxes and leverage
Trezevant [27]	1992	US companies	Relationship between corporate taxes and debt
Rajan,Zingales [9]	1995	G7, compared financial policies across countries	Use of debt is higher in countries with higher corporate tax rates
Schulman et al. [28]	1996	Canada, New Zealand from 1982–1991	Debt levels are positively correlated with tax rates
Shum [29]	1996	45 countries, 1978–1989	Use of debt increases under certain circumstances
Cloyd et al. [30]	1997	US small, closely held corporations	Taxes had a significant influence on the firm's decision of using debt
Gordon, Lee [31]	2001	US statistics of income balance sheet data on all corporations for 46 years from 1950-1996, to compare the debt policies of firms of different sizes	Taxes have a strong and statistically significant effect on debt levels
Fan et al. [8]	2012	39 countries, from 1991–2006, 36,767 firms	Taxation has a positive effect on leverage in developed countries
Graham and Harvey [6]	2001	Interview 392 CFOs in the U.S.	Tax advantage of interest deductibility is of significant concern by CFOs in large companies

Table 2. Description of Literature review, cont'd

Name	Year	Study	Results
Ayers et al. [32]	2001	Sample of small U.S. firms, <500 employees	Negative relationship between the tax rate and debt revealed
Buettner et al. [33]	2009	Multinationals affiliates 26 countries, 1996 to 2003	Positive tax impact for both types of debt: internal and external
Dhaliwal et al. [34]	2007	Effect of changes in personal tax rates, the sample is divided: 1994–1997, 1997–2003, 2003–2007	Positive relations between tax and leverage
Overesch, Voeller [35]	2008	23 European countries, 2000 to 2005	Positive effect of debt tax benefit on financial leverage
Klapper, Tzioumis [36]	2008	Post-2001 tax reform event in Croatia	Positive relations between taxes and firm leverage
Jong et al. [37]	2008	Companies and regimes in 42 countries	No relation between taxation and debt
Bas et al. [12]	2009	25 developing countries from different regions, 27826 firms	The larger the firm, the higher the leverage
De Socio, Nigro [14]	2012	European companies, 2004 to 2007	Positive effect of corporate income tax on corporate leverage
Hemmelgarn, Teichmann [13]	2014	Banks, 25 countries around the world, 1997 to 2011	Bank's leverage increases along with the tax rate
Longstaff, Strebulaev [11]	2014	US private and public companies, 1926–2009	Strong positive relation between taxes and leverage
Dwenger, Steiner [21]	2014	The impact of profit taxation on the financial leverage of firms.	Tax rate has a significant and relatively large positive impact on corporate leverage; debt ratio is less responsive to tax incentives for small corporations
Miniaci, Parisi,Panteghini [22]	2014	Analysed the relationship between subsidiary capital structure and European taxation using tradeoff model	An increase in the parent company's tax rate reduces the tax benefits of shifting debt from the parent company to its subsidiary
Faccio, Xu [23]	2015	Do taxes affect corporate capital structure choice, and if so how large is their economic effect?	Both personal and corporate tax rates have statistically significant relationship with leverage, and the economic impact of tax changes on capital structure appears to be large

Table 3. Models used in literature review papers

Name	Year	Model	Results; Tax rate
Givoly, Hayn [25]	1992	$\Delta Lev = \alpha + \beta_1 ETR + \beta_2 \Delta Dep + \beta_3 \Delta ITC + \beta_4 NOLCC + \beta_5 DYLD + \beta_6 Size + \beta_7 BRisk + \beta_8 TBQ + \xi_i$	Personal taxes play an important role in capital structure decisions; Corporate tax rate
Rajan,Zingales [9]	1995	$\Delta Lev(Firm_i) = \alpha + \beta_1 TangAssets + \beta_2 \frac{MV}{BV} + \beta_3 Ln(Sales) + \beta_4 ROA + \xi_i$	Use of debt is higher in countries with higher corporate tax rate; Corporate tax rate
Schulman et al. [28]	1996	$Lev_{it} = \alpha + \beta_1 TInt_t + \beta_2 CTax_t + \beta_3 CTax_t TInt_t + \beta_4 Size_{it} + \beta_5 DS\,\mathrm{ec}_{it} + \beta_6 STK_t + \beta_7 Infl_t + \xi_{it}$	Debt levels are positively correlated to tax rates; Marginal tax rate
Shum [29]	1996	$B_{it} = \alpha' W_{it} + \beta_1 \widehat{T^*}_{it-1} + \xi^*_{it}$	Use of debt increases under concrete circumstances; Corporate tax rate
Cloyd et al. [30]	1997	$IGP_i = \alpha + \beta_1 INS_i + \beta_2 SEN_i ND_i + \beta_3 SEN_i ND_i + \beta_k X_{ki} + \xi_i$	Taxes had a significant influence on the firm's decision of using debt; Corporate tax rate
Gordon, Lee [31]	2001	$\frac{D_{st}}{A_{st}} = \sum_{i=0}^{7} \alpha_i \log(A^r_{st})^i + \beta\,(r_{st} + z_t(1-r_{st}) - m_t) + X_{st^y} + \sum_{t \neq 1954} \delta_t d_t + \xi_{st}$	Taxes have a strong and statistically significant effect on debt levels; Corporate tax rate
Ayers et al. [32]	2001	$OUTINT_i = \alpha + \beta_1 Tax_i + \beta_2 Tax_i OCCOMP_i + \beta_3 Tax_i Depr_i + \beta_4 Tax_i Rent_i + \beta_k X_{ki} + \xi_i$	Negative relationship between the tax rate and debt; Marginal tax rate
Buettner et al. [33]	2009	$Y_{j,k,t} = \alpha + \beta_1 x_{j,k,t} + \beta_2 T_{j,t} + \beta_3 \log i_{j,t} + \beta_k + \beta_t + \xi_{j,t,k}$	Positive tax impact for both types of debt: internal and external; Corporate tax rate

Name	Year	Model	Results; Tax rate
Dhaliwal et al. [34]	2007	$Type = \alpha + \beta_1 TRD97 + \beta_2 TRD03 + \beta_3 Yield + \beta_4 Inst + \beta_5 TRD97Yield + \beta_6 TRD03Yield + \beta_7 TRD97Inst + \beta_8 TRD03Inst + \beta_9 t_{cDUM} + \beta_{10} PPEITA + \beta_{11} TobinQ + \beta_{12} \Delta Price + \beta_{13} Size + \beta_{14} EarnVar + \beta_{15} AAA + \beta_{16} IPO + \beta_{17} Proceed + \sum_{i=1}^{7} \beta_{18tj} IND_{jt}$	Positive relations between tax and leverage; Corporate tax rate
Overesch, Voeller[35]	2008	$Debt\ to\ Assets_{it} = \alpha + \beta_{11} r_{it}^C + \beta_{12} r_{it}^D + \beta_{13} r_{it}^I + \beta_2 X_{it} (r_{it}^C \times Tang_{it}) + \beta_4 (r_{it}^C \times LossCarryforward_{it}) + \delta_i + \gamma_t + \xi_{it}$	Positive effect of debt tax benefit on financial leverage; Effective tax rate
Bas et al. [12]	2009	$Lev_{it} = \alpha + \beta_1 Tang_{it} + \beta_2 Prof_{it} + \beta_{3A} Small_i + \beta_4 \frac{GDP}{Cap_t} + \beta_5 Growth_t + \beta_6 Inf_t + \beta_7 Interest_t + \beta_8 Tax_t + \xi_{it}$	The larger the firm, the higher the leverage; Corporate tax rate
Barakat, Rao [10]	2012	$\frac{D}{E} = \alpha + \beta_1 MTR\ Dtax + \beta_2 NDTS + \beta_3 MB + \beta_4 DivNI + \beta_5 TANTA + \beta_6 LNS + \beta_7 SDOE + \beta_8 EBITTA + \xi$	Significant and positive impact on financial leverage; Marginal tax rate
Hemmelgarn, Teichmann [13]	2014	$\Delta(Capital\ Structure)_{it} = \alpha + \Delta Tax\ rate_{ct-1} + \Delta Tax\ rate_{ct-2} + \Delta Tax\ rate_{ct-3} + \Delta Tax\ rate_{ct-4} + \Delta(\log(TA))^2_{it} + \Delta PretaxROA_{it} + \Delta \log(GDP)_{ct} + \Delta CPI_{ct} + \Delta(\min CapRequirement)_{ct} + + \Delta(CapStrungencyIndex)_{ct} + \Delta(Existance\ of\ DepositInsurance)_{ct} + \Delta(GovEffectivenessIndex)_{ct} + \delta_j + \gamma_t + \xi_{it}$	Bank's leverage increases along with the tax rate; Corporate tax rate
Longstaff, Strebulaev [11]	2014	$\Delta Lev_t = \alpha + \sum_{i=1}^{2} \beta_i \Delta Lev_{t-1} + \sum_{i=1}^{3} \gamma_t \Delta Tax\ Rate_{t-1} + \delta_1 \Delta CashRatio_{t-1} + \delta_2 \Delta CurrentRatio_{t-1} + \delta_2 \Delta CurrentRatio_{t-1} + \delta_3 Prof_{t-1} + \xi_t$	Strong positive relation between taxes and leverage; Corporate tax rate

The authors, in their various research papers, used the following tax rate models in their analyses:

Corporate tax rate: a tax paid by the firm on its earnings; there are different tax rates for different profit levels.

Marginal tax rate: tax that the firm pays on its additional dollar of income; it can increase as income increases.

Effective tax rate: an average tax rate that the firm pays; It can be calculated by dividing income tax expenses by pretax income.

Data and Methodology

The present research studies the relationships between leverage and the effective tax rate. This paper studies the influence of tax rates on companies' capital structure in each of BRICS countries and determines their statistical effect.

The dataset consists of firm level data for public companies from BRICS countries from different industries (except the financial sector) between 2010 and 2014. Company financial data were retrieved from the Bloomberg database. All the data is presented in millions of US dollars. Recently, according to official data, China, Brazil, and India started a process of transition from National Accounting Standards to International Financial Reporting Standards (IFRS). Since the companies from each country will be analysed separately (between countries) and since the national standards of these countries are very close to IFRS, it is assumed below that it is possible to conduct the regressions separately for each country's companies and then to compare results. This will indicate the influence of the effective tax rate on the capital structure. Although most determinants are the same, each country has its own model, since some variables are significant in certain countries and not in others.

This research uses the fixed effects model in order to estimate the regressions. Then, using the panel regressions method with fixed effects, it is possible to provide evidence that a change in tax rates affects a company's capital structure.

However, for the purposes of this research the corporate tax rate has been swapped in favour of the effective tax rate, since in BRICS countries there are no marginal tax rates provided by their national GAAPs.

Effective tax rate. This indicator should positively affect the leverage of the company, due to the fact that interest payments are tax deductible, i.e. a higher tax rate implies greater tax shield benefits, therefore there is a positive relation between tax rate and leverage. I. Ivashkovskaya and M. Solntseva (2007) [38], in their research on Russian data, obtained results that support negative a relation between tax rate and leverage.

Return on assets. This is calculated as the net income value divided by the total assets value. According to the tradeoff theory, more profitable companies will use debt to take greater advantage of increasing tax shields benefits. However, the pecking order theory states that more profitable companies will less use debt and therefore the leverage will decrease.

Size. This is an important determinant that impacts the capital structure of the company. It is calculated as a natural logarithm of total assets. Most papers state that the size of a company has a positive relation with the debt financing level, because large companies have a lower risk of bankruptcy, according to E.K. Kayo and H. Kimura (2011) [39]. Also, according to S. Byoun (2008) [40] large companies have lower agency costs, easier access to credit markets, and less volatile cash flows. However, I. Ivashkovskaya and M. Solntseva (2007) [41] in their investigation into data on Russian companies, identified a negative relation between debt level and the size of the firm. This fact can be explained with high agency costs and with asymmetry of information.

Depreciation/Sales. This factor is a non-debt tax shield and it has a positive relation with the leverage of the company, according to M. Faccio, J. Xu (2015) [23] and I. Ivashkovskaya, M. Solntseva (2007) [38]. This indicator may also have a negative relation with debt level.

Tangibility. This is calculated as tangible assets divided by total assets. According to the pecking order theory, tangibility is negatively related to leverage, however tradeoff theory supports a positive relation between them (Baltaci and Ayaydin, (2014) [42]).

Inflation rate. This is an important macroeconomic indicator. According to K. Jõeveer (2013) [43] and M. Faccio, J. Xu (2015) [23], it is positively related to debt level, since the real value of a debt's tax deductions becomes higher.

Profitability – This variable is calculated as earnings before interest and tax divided by revenue. According to the pecking order theory profitability has a negative relation with the company's debt level.

LIBOR. This acronym stands for London Interbank Offered Rates.

GDP increment. This value is calculated as a natural logarithm of GDP in period *t* divided by GDP in period t-1.

Growth rate. This is a macroeconomic indicator that can have either a positive or negative relation with the level of debt. According to tradeoff and pecking order theories, it has a negative effect on leverage. For example, Huang and Song (2006) [44] found that growth is negatively related with the leverage.

Table 4. Impact of the determinants on capital structure

Variable	Decipher	Description	Impact on leverage	Author
		Dependent variable		
Total debt to Total assets	D/A	Financial leverage		
		Independent variables		
Effective tax rate	Effective tax rate	Calculated as income tax divided by pre-tax income	Positive/Negative	Positive: Graham (2003) [3] Negative: Ivashkovskaya, Solntseva (2007) [38]
Return on assets	ROA	Calculated as net income divided by total assets. Positive relation: tradeoff theory; Negative: pecking order theory	Positive/Negative	Negative: Faccio, Xu (2015) [23]
Size	Size	Calculated as a natural logarithm of total assets. Positive relation is suggested by tradeoff theory	Positive/Negative	Kayo and Kimura (2011) [39]; Ivashkovskaya, Solntseva (2007) [38]
Depreciation/ Sales	Depreciation/ Sales	Calculated as depreciation divided by sales	Positive/Negative	Positive: Faccio, Xu (2015) [23]; Ivashkovskaya, Solntseva (2007)[38]
Tangibility	Tangibility	Calculated as tangible assets divided by total assets	Positive/Negative	Positive: Byoun (2008) [40]; Kayo and Kimura (2011) [39]; Ivashkovskaya, Solntseva (2007) [38]
Inflation rate	Inflation	Inflation rate	Positive	Jõeveer (2013) [43];Faccio, Xu (2015) [23]
Ni/Revenue	Ni/Revenue	Net income margin	Positive	
Profitability	Profitability	Calculated as earnings before interest and tax divided by revenue	Negative	Ivashkovskaya, Solntseva (2007) [38]
LIBOR	LIBOR	London Interbank Offered Rates	Positive	
GDP increment	$\ln\left(\frac{GDP_t}{GDP_{t-1}}\right)$	Calculated as a natural logarithm of GDP in period *t* divided by GDP in period *t-1*	Negative	Faccio, Xu (2015) [23]
Growth rate	Growth rate	Calculated as capital expenditure divided by total assets. According to the tradeoff and pecking order theories it has a negative effect on leverage.	Negative	Brierley and Bunn (2005) [45]

Evaluation and Estimation

In this chapter I conduct detailed regression analyses for each of the BRICS countries and present results. Each country's data was analysed separately using panel regressions with fixed effects and random effects. The algorithm for the analysis was identical for each country's panel data.

The analysis of panel data involved estimation of three types of regression: pooled, fixed effects and random effects. On the first step, using the F-test, I determined whether the pooled OLS or the fixed effects model is more suitable. Then, using Breusch-Pagan test, I determined whether the pooled OLS or random effects regression is more suitable. Additionally, a Hausman test was used to justify the use of the FE (fixed effect) or RE (random effects) model. Next, the option "vce(robust)" was added to control the model for heteroskedasticity. Thus, the most suitable model with robust results was obtained – a fixed effects model for Brazil, India, China and South Africa, but with a random effects model as the most suitable model for Russia.

The results for each country (final model variable coefficients with levels of significance) are presented in tables in their sections: Brazil, Russia, India, China and South Africa. It should be noticed that the results for each country have been obtained after the elimination of all insignificant variables from the respective regressions.

Russia

The sample consists of 340 firm-year observations for Russian companies from 2010 to 2014 (5 years). A panel regression model with random effects was utilized. The coefficient of determination of the model (i.e. R-sq) is equal to 0.23.

The final model appears thusly:

$$Leverage_{it}\ or\left(\frac{D}{A}\right)_{it} =$$
$$= \alpha + \beta_1 Effective\,tax\,rate_{it} + \beta_2 ROA_{it} + \beta_3 Size_{it} +$$
$$+\beta_4 Growth_{it} + \beta_5 GDP\,increment_{it} + \beta_6\left(\frac{EBIT}{EBT}\right)_{it} + \xi_{it}$$

Table 5. Panel regression results for Russian companies, with random effects model

Variable	Total debt/Total assets
Effective tax rate	−4.55* (3.23) p-value: 0.15
Growth	2.80 (3.7)
Size	−0.05 (−0.05)
EBIT/EBT	0.26** (0.14)
GDP increment	−18.1**** (5.39)
ROA	−30.6**** (7.79)
Observations	340
R-sq within	0.23

Levels of significance: 1%****, 5%***, 10%**, 15%*.

Brazil

The sample is comprised of 910 firm-year observations for Brazilian companies from 2010 to 2014 (5 years). A panel regression model with fixed effects was utilised. The coefficient of determination of the model (i.e. R-sq) is equal to 0.15.

The final model is presented here:

$$Leverage_{it}\ or\left(\frac{D}{A}\right)_{it}$$
$$= \alpha + \beta_1 Effective\,tax\,rate_{it} + \beta_2 ROA_{it} + \beta_3 Size_{it} +$$
$$+\beta_4\left(\frac{Depreciation}{Sales}\right)_{it} + \beta_5 Tangibility_{it} + \beta_6 Inflation_{it}$$
$$+\beta_7\left(\frac{NI}{\mathrm{Re}venue}\right)_{it} + \beta_8\left(\frac{EBIT}{EBT}\right)_{it} + \xi_{it}$$

Table 6. Panel regression results for Brazilian companies, with fixed effects

Variable	Total debt/Total assets
Effective tax rate	0.061** (0.37) p-value: 0.109
ROA	−35.30**** (12,46)
Size	1.270 (1,23)
Depreciation/Sales	2.030**** (0,8)
Tangibility	−10.60**** (3,2)
Inflation	98.55* (61.8)

Variable	Total debt/Total assets
NI/Revenue	0.080**** (0.02)
EBIT/EBT	−0.030 (0.04)
Observations	910
R-sq within	0.15

Levels of significance: 1%****, 5%***, 10%**, 15%*.

India

The sample consists of 905 firm-year observations for Indian companies from 2010 to 2014 (5 years). A panel regression with fixed effects is utilised. The coefficient of determination of the model (i.e. R-sq) is equal to 0.12.

The final model is presented here:

$$Leverage_{it}\ or\left(\frac{D}{A}\right)_{it}$$
$$= \alpha + \beta_1 Effective\,tax\,rate_{it} + \beta_2 ROA_{it} + \beta_3 Size_{it} +$$
$$+ \beta_4\left(\frac{Depreciation}{Sales}\right)_{it} + \beta_5 Profitability_{it} + \beta_6 Inflation_{it} +$$
$$+ \beta_7 LIBOR_{it} + \beta_8\left(\frac{EBIT}{EBT}\right)_{it} + \xi_{it}$$

Table 7. Panel regression results for Indian companies, with fixed effects

Variable	Total debt/Total assets
Effective tax rate	−0.48** (0.3) p-value: 0.106
ROA	1.36**** (0.37)
Size	8.63**** (2.77)
Depreciation/Sales	−2.01**** (0.72)
Inflation	66.79**** (13.9)
Profitability	−4.53 (3.61)
EBIT/EBT	0.04 (0,04)
LIBOR	851.2**** (199,9)
Observations	905
R-sq within	0.12

Levels of significance: 1%****, 5%***, 10%**, 15%*.

South Africa

The sample includes 760 firm-year observations for South African companies from 2010 to 2014 (5 years). A panel regression with fixed effects is utilised. The coefficient of determination of the model (i.e. R-sq) is equal to 0.11.

The final model looks like:

$$Leverage_{it}\ or\left(\frac{D}{A}\right)_{it}$$
$$= \alpha + \beta_1 Effective\,tax\,rate_{it} + \beta_2 ROA_{it} + \beta_3 Size_{it} +$$
$$+ \beta_4\left(\frac{Depreciation}{Sales}\right)_{it} + \beta_5 Tangibility_{it} + \beta_6 Inflation_{it} +$$
$$+ \beta_7\left(\frac{NI}{\mathrm{Re}venue}\right)_{it} + \beta_8\left(\frac{EBIT}{Total\ Assets}\right)_{it} + \xi_{it}$$

Table 8. Panel regression results for South African companies, with fixed effects

Variable	Total debt/Total assets
Effective tax rate	−0.05*** (0.02) p-value: 0.041
ROA	−11.90**** (4.12)
Size	7.61**** (2.07)
Depreciation/Sales	26.7* (17.7)
Tangibility	0.72**** (0.2)
EBIT/Total assets	5.30 (4.6)
Observations	760
R-sq within	0.11

Levels of significance: 1%****, 5%***, 10%**, 15%*.

China

The sample includes 4000 firm-year observations for Chinese companies from 2010 to 2014 (5 years). A panel regression with fixed effects is utilised. The coefficient of determination of the model (i.e. R-sq) is equal to 0.07.

The final model looks like:

$$Leverage_{it}\ or\left(\frac{D}{A}\right)_{it}$$
$$= \alpha + \beta_1 Effective\,tax\,rate_{it} + \beta_2 ROA_{it} + \beta_3 Size_{it} +$$
$$+\beta_4\left(\frac{Depreciation}{Sales}\right)_{it} + \beta_5 LIBOR_{it} + \beta_6 Inflation_{it} +$$
$$+\beta_7 Growth_{it} + \xi_{it}$$

Table 9. Panel regression results for Chinese companies, with fixed effects

Variable	Total debt/Total assets
Effective tax rate	0.14**** (0,04) p-value:0.002
ROA	−39.62**** (7,39)
Depreciation/Sales	−1.680**** (0,41)
Size	3.310**** (0,93)
LIBOR	206.79*** (73,67)
Inflation	89.95**** (18,57)
Growth	−7.23* (4,9)
Observations	4000
R-sq within	0.07

Levels of significance: 1%****, 5%***, 10%**, 15%*.

Conclusion

In this work, I investigated the impact of taxation on the capital structure of companies in BRICS countries. During this research, regression analyses were conducted for the companies of each of BRICS countries. These regression analyses showed that for all countries except Russia, the most suitable regression model is the fixed effects method, but for Russia the most appropriate model is the random effects method. The obtained results indicate that effective tax rate is an important capital structure determinant, and it is significant across all countries.

Effective tax rate has an ambiguous effect on the leverage of companies, that is, it is either positive or negative. In countries such as Russia, India, and South Africa, effective tax rate has a significant negative relationship with financial leverage. This fact contradicts most existing financial literature, where effective tax rate has a positive relationship with the capital structure. The negative impact on leverage of the effective tax rate can be explained through the regulated expenses for income tax (as seen in Russia). Also, in the paper of I. Ivashkovskaya, M. Solntseva (2009) [41], the authors identified a negative relationship between tax and capital structure. They explained this result as follows: the higher the tax savings caused by payment of debt interest, the lower the level of leverage. However, the effective tax rate's impact on capital structure of Brazil and China is in line with most researches in that there is a positive relationship between effective tax rate and capital structure.

The results of the present study indicate that the return on assets (ROA) value is negatively related to leverage in Brazil, South Africa, Russia and China. This result corresponds to the pecking order theory, which states that companies should prefer internal financing. However, ROA was found to be positively related to capital structure in India, which is a result supported by the tradeoff theory.

Moreover, the size of the firm was found to have a positive relationship with leverage in all countries except Russia, where this determinant is insignificant. This result corresponds to the research by S. Byoun (2008)[40], which indicates that large companies have lower agency costs, easier access to credit markets and less volatile cash flows.

Further analysis of the determinant designated as 'depreciation/sales' reveals that it is positively related [23] to leverage in Brazil and South Africa. This coincides with the results of M. Faccio, J. Xu (2015) and I. Ivashkovskaya, M. Solntseva (2007) [38], whereas an opposite result was obtained for India and China.

Finally, the tangibility variable was seen to negatively relate to capital structure in Brazil, but positively so in South Africa, and inflation has a positive sign and is significant in Brazil, India and China. There are some other significant determinants, but they are unique for each country. According to these results it may be concluded that these countries' samples cannot be combined or analysed as a unified dataset, because they are too different and demonstrate too much complex variation.

In accordance with the results obtained during the analyses, the following conclusions may be stated regarding the hypotheses articulated earlier:

H1: The effective tax rate positively relates to company leverage in BRICS countries.

This hypothesis has been rejected for Russia, India and South Africa, but proven for Brazil and China.

H2: The return on assets negatively relates to company leverage in BRICS countries.

This hypothesis has been proven for Russia, Brazil, South Africa and China, but rejected for India.

H3: The inflation rate positively relates to the company leverage in BRICS countries.

This hypothesis has been rejected for Russia and South Africa, but proven for Brazil, India and China.

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Analysis of Determinants of the Speed of Adjustment to Target Capital Structure of Companies in Developing Economies

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Abstract

The financial stability of a company, along with its operational effectiveness, depend on whether the company endeavours to optimise its capital structure, and the speed at which it can do so. The purpose of this article is to assess the relative impact of influential factors on the speed of adjustment to the optimal capital structure of companies in emerging markets. The relevant factors in question include corporate determinants, macroeconomic determinants, the specific financial characteristics of BRICS companies, and other pertinent external macroeconomic conditions.

To achieve this, we conducted a comparative study of various assessment methodologies and examined their findings. Within the scope of the overall study aims, we considered various models of assessing the speed of adjustment and identified those study methods most frequently used. We identified the determinants of optimal capital structure and the related speeds of adjustment, and suggested hypotheses based on assumed assessment results. We then proceeded to analyse the sustainability of those results and gauge the overall robustness of our approach.

The study results reveal that the speed of adjustment to target capital structure in developing economies is significantly higher than in advanced economies. The results indicate that these speeds vary in the range of 31–46% for book values of financial leverage and 60–79% for its market values. An empirical analysis of these results also showed that companies with a less-than-optimal debt level achieved the optimum level much quicker, and the speed of adjustment thereby depends heavily on the absolute value of the company money flow. Moreover, this is especially true in those companies with an excessive leverage value. Financial instability in the markets, meanwhile, had a positive effect upon the speed of adjustment for Chinese and Brazilian companies, while in the other BRICS countries the change of the speed of adjustment in the period of crisis finds no confirmation.

Keywords: speed of adjustment, capital structure, trade-off theory, agency conflict, pecking order theory, market timing theory, DPF method, least square method, instrumental variables method, generalized method of moments, partial adjustment model

JEL classification: G32, G34

Introduction

Over a number of years, the subject of the capital structure of a company has been one of the most pressing and studied topics of financial economics. Commencing from the paper [1] (the main conclusion of which consists in the irrelevancy of choice of the capital structure from the point of view of its influence on the company value) several theories which explain the choice of the companies' capital structure were developed. The main purpose of these theories has been the theoretical justification of company conduct when choosing the capital structure. There was no conventional theory which explained the company capital structure before the research by Modigliani/Miller. So, this theory became the starting point for all subsequent research into this structure. At the same time, thanks largely to the fact that the conclusions of the 'irrelevancy hypothesis' of capital structure contradicted empirical facts, the study of this problem progressed in multiple directions. Mainly the Modigliani/Miller paper was criticized for its rather rigid and unrealistic prerequisites, which had little in common with the real conditions of operation in financial markets and the economy in general. Inasmuch as the theory implicates ideal financial markets, introducing any 'imperfect' variables such as taxes, transaction costs, agency conflicts or the costs of bankruptcy results in erroneous conclusions being reached.

However, one of the lines of further development of the theory of capital structure of a company were models based around consideration of the agency costs of a company's debt financing [2]; [3]. This approach served as the backbone of the trade-off theory of capital structure. This theory considers the optimum level of debt in a company, which is defined on the basis of the balance of benefits and costs of the financial leverage increase, as well as those factors which may be the source of such benefits and costs. Concerning agency costs, it is usual to place emphasis on the conflict of interest between managers and shareholders which emerges due to managers' disposition toward ineffective employment of company resources and the enlargement of their own privileges. Thus, the higher the company debt level, the less disposable assets are available to the managers and the more effective their performance should be in order to handle a high debt level. At the same time, a high debt level results in an agency conflict between the shareholders and creditors. Such conflicts are based around a transfer by the shareholders to the creditors of a selection of risks, where the shareholders prefer to implement high income projects which are more risky, even with a negative *NPV* value [4]; [5]. Apart from the aforementioned disagreements, other agency conflicts are highlighted, e.g. conflicts related to the company's possible liquidation [6] or insufficient investment [7]. Along with the balance among various agency conflicts, the main factor defining the optimum debt level of a company is the ratio of benefits from the growing tax shield to the increasing costs of bankruptcy, as studied in the paper [8]. Use of debt financing helps a company to realize benefits related to alleviation of taxes by the costs of debt interest payment. The higher the debt level of a company, the more it saves on taxes and the higher the company value is. At the same time, an increase in the debt load results in the growth of bankruptcy risks of a company because at some point the free cash flow may be insufficient to fulfill the debt liabilities. Consequently, the optimal capital structure of a company is achieved in cases where equality of benefits and costs of the debt level increase, and is defined by the financial characteristics of the company and the factors which influence the amount of benefits and costs of raising debt funds.

One of the restrictions of early papers on the trade-off theory is the fact that the models of the optimal capital structure are single-period ones and do not take into consideration such factors as expectations and the dynamics of adjustment to the optimal debt level. In this regard, the trade-off theory developed from static models to dynamic ones [9]; [10] which enables it to take into consideration the influence of uncertainty on the dynamics of financial leverage. These models offer an opportunity to understand how companies achieve the optimal level of financial leverage and which particular factors define its dynamics.

Along with the trade-off theory, other theories which substantiate the capital structure of a company are pointed out. One of them is the pecking order theory in accordance with which companies finance their activity, first, from their internal funds, then use debt financing and, last of all, using the option of joint-stock capital [8]. Another very popular theory is the market timing theory, which presumes that a company issues or takes up shares depending on whether they are overvalued or undervalued by the market relative to their fundamental value [11]. In spite of differences in the theories explaining the choice of the company capital structure, models of dynamic trade-off choice are the most high-demand and widely used ones. Thanks to this concept, it is now possible not just to analyze the factors which influence a company's financial leverage, but also to detect the determinants of optimal capital structure and the speed of adjustment to it. This has become one of the most important courses of research development in this sphere.

The trends of the empirical analysis of interrelations between characteristic features of companies on the one hand, and economics with capital structure on the other, are characterized by increasing absorption by its optimization procedure. Increasingly greater attention is paid to defining how quickly companies take corresponding decisions and which factors influence this, rather than to validation of conclusions of the trade-off theory in practice, or to the assessment of the optimal capital structure. This paper is dedicated not only to research of determinants of the capital structure itself, but also to the way company characteristics influence the speed of adjustment of the company to the optimum, and whether these dependencies are the same in developing economies as they are in advanced economies.

The research of the speed of adjustment to the optimal capital structure has made significant progress in the

advanced economies, and over the last several years it has become of increasing relevance in developing economies. At the same time, the majority of papers focus on assessment of the value of the speed of adjustment itself, as well as analyses of individual sub-selections for various types of companies, countries and institutional conditions. The attempts to assess the influence of various determinants within one model which would take them into consideration as continuous variables (and would not depend on subjective breaking down into categories) are rather exceptional, even for developed markets.

In this paper, the influence of various determinants on the speed of adjustment to the optimal capital structure is analyzed, taking particular account of the continuity of values of the considered factors within one joint model. This enables us to exclude the influence of unaccounted determinants on the obtained assessments. Moreover, assessment of the speed of adjustment to the optimal capital structure is related to serious methodological difficulties. In this research, we applied the *DPF* method, which has proved itself in recent researches as the most accurate and reliable way of assessment of the value of the speed of adjustment. This methodology will help to obtain improved assessments of the speed of adjustment in emerging markets, and to evaluate accurately how various determinants influence its value.

Comparative Analysis of the Speed of Adjustment to the Optimal Capital Structure

Analysis of the Dynamic Model of the Capital Structure Applying the Least Square Method

Analysis of the speed of adjustment to the optimal capital structure is one of the most relevant topics of research in the recent years. Assessment of dynamic changes of the capital structure has remained unexamined for a long time, however, with the advent of corresponding theoretical tools and empirical testing development, research into this topic took a significant leap. One of the first papers dedicated to an analysis of the dynamics of the capital structure and factors which influence it was the article [12]. In spite of the fact that the existing capital structure of companies cannot be explained unambiguously by a single theory, an important conclusion is that the dynamics of financial leverage are described in terms of deviations from some average level. This is indicative of the presence of the optimal capital structure following from the trade-off theory. Using the model of partial adjustment to the optimal capital structure (similar to the dividend model of J. Lintner [13]) the authors evaluated the speed of adjustment to the optimal capital structure for those companies which paid dividends on their shares, and those companies which did not make such payments. Depending on whether book or market values for calculating a company's financial leverage were used, the speed of adjustment to the optimal capital structure amounted to 7–10% for the selection of the companies paying dividends, and to 15–18% for the companies paying no dividends. A higher speed of adjustment in the companies making no dividend payments may be explained by the fact that such companies have more disposable assets which may be used to discharge a debt, while the companies paying dividends cannot pursue such a flexible policy, not least because reduction of dividends adversely affects the company value [14]. It is worth noting that adjustment to the optimal capital structure according to the estimations obtained by this paper is very slow: a company covers half of the distance between the current and optimal value of its financial leverage for 9.6 to 3.5 years according to the minimum and maximum values of the speed of adjustment respectively. Applying the least square method to assess the speed of adjustment to the optimal capital structure results in biased estimates of coefficients and an underestimation of the speed of the financial leverage adjustment. In the research [15] the speed of adjustment is estimated as 8.3%–10%, which is less than the values obtained in the papers by E. Fama and K. French. In other papers the estimates obtained by the least square method also show rather low estimates of the speed of adjustment. In the research [16] the speed of adjustment of the book leverage value to the target level amounts to 17%, and in the paper [17] it is assessed as between 22%–23% for book and market values respectively (Table 1).

Table 1. Comparison of the Estimates of the Speed of Adjustment to the Optimal Capital Structure Obtained by the Least Square Method

Author, year	Country, period	Speed of adjustment, %
Fama, French, 2002	USA, 1965–1999	Book leverage: 10–18 Market leverage: 7–15
Kayhan, Titman, 2007	USA, 1960–2003	Book leverage: 10 Market leverage: 8,3
Lemmon, Roberts, Zender, 2008	USA, 1965–2003	Book leverage: 17
Byoun, 2008	USA, 1971–2003	Book leverage: 23, Market leverage: 22

Author, year	Country, period	Speed of adjustment, %
Huang, Ritter, 2009	USA, 1972–2001	Book leverage: 9,3 Market leverage: 11
Flannery, Rangan, 2006	USA, 1966–2001	Market leverage: 14,6
Hovakimian, Li, 2011	USA, 1970–2010	Market leverage: 13

Table 2. Comparison of the Estimates of the Speed of Adjustment to the Optimal Capital Structure Obtained by the Least Square Method Taking into Consideration the Fixed Effects Model

Author, year	Country, period	Speed of adjustment, %
Lemmon, Roberts, Zender, 2008	USA, 1965–2003	Book leverage: 39
Byoun, 2008	USA, 1971–2003	Book leverage: 39 Market leverage: 32
Hovakimian, 2011	USA, 1970–2010	Market leverage: 17
Huang, Ritter, 2009	USA, 1963–2001	Book leverage: 74 Market leverage: 77
Frank, Goyal, 2008	USA, 1993–2004	Market leverage: 46
Flannery, Rangan, 2006	USA, 1966–2001	Market leverage: 38

Low estimates of adjustment to the optimal capital structure was but one of the factors accompanying a significant development in this sphere of research. Methodology of assessment of the speed of adjustment to the optimal capital structure was one of the key factors influencing the obtained results. In consideration of this, various methods of assessment were applied in subsequent papers.

Taking into Consideration Fixed Effects in the Model of the Least Square Method

One of the areas of development involved the application of the least square method with fixed effects, which helped to take into consideration special characteristics of companies evaluating models in terms of the variables' departure from mean values.

The results of research based on this assessment method show a significantly higher speed of adjustment to the optimal capital structure than the ones using the least square method. Thus, the speed of adjustment in the paper [16] for the book leverage value is estimated as 39%, in the paper [17] it amounts to 32–39% (for market and book values of leverage respectively), and in the paper [18] it is calculated betwen 74 and 77%. Conspicuously, the obtained estimates differ significantly from the results of the least square method, and companies adjust very quickly to the optimal capital structure (Table 2).

The ordinary least square method and the least square method with fixed effects may result in biased estimates due to serious problems related to the assessment of panel data. Apart from the endogeneity problem emerging (because it is necessary to include lagged variables in the model) the biased estimates may be caused by short observation periods, panels imbalance, missed data, or censored data. The study of applicability of the abovementioned methods in estimating the speed of adjustment to the optimal capital structure revealed that both methods result in biased estimates of the speed of adjustment [19]; [16]; [18]. Therefore, including a fixed effects of companies variable in the model causes overestimation of the speed of adjustment. As a result, the real values of the speed of adjustment should be identifiable between the estimates obtained by the ordinary least square method and the least square method with fixed effects [20].

Application of the instrumental variables method discovered in the paper [21] allows us to solve the endogeneity problem, which results in biased estimates when using the least square method. As an instrument for market leverage, the author uses the values obtained from the book values of debt and shares. This is intended to facilitate the elimination of residual autocorrelation and the attaining of unbiased estimates. The estimates of the speed of adjustment obtained in this way should be between the estimates of the ordinary least square method and the least square method with fixed effects, namely within the range of 14.6–34.3%. However, the applied instrumental variables method assessed the speed of adjustment as 52.3% which contradicts the expectations. The instrumental variables method is highly sensitive to the quality of the utilised tools and requires a high correlation with the instrumented variable and absence of correlations with

errors. That is, the method should be relevant, and valid. In this respect, the book value of the financial leverage is unable to properly explain the dynamics of its market value, as it is a weak instrument, which results in biased estimates. In view of this, the practical application of the instrumental variables method to assess the speed of adjustment to the optimal capital structure prevents us from obtaining reliable results, thus making this method unsuitable.

The abovementioned results of previous research assess the mean speed of adjustment of companies to the target value of the leverage irrespective of special characteristics and external factors which can influence the speed of adjustment. It is possible to detect differences in the speed of adjustment for various types of companies, comparing the results obtained in sub-selections, as for instance in the paper [12]. That paper studies sub-selections of companies depending on whether those companies pay dividends or not. Thus, when assessing the ordinary model of partial adjustment for the selection of all companies, it is implicitly implied that the speed of adjustment is equal, irrespective of whether the optimal level of company capital is higher or lower. Neither the value of deviation from this level, nor the opportunities and costs of small adjustments to the optimum (as well as many other factors which may influence the speed of adjustment) are taken into consideration. The assumption of homogeneity of the speed of adjustment is a rather serious simplification of reality. This assumption may be applied to empirically confirm the validity of the procedure of small adjustment of the capital structure to the target level. One of the means of taking into account heterogeneity of the speed of adjustment is including in the model of dummy variables. These variables describe the specific character of the studied companies or external qualitative factors. So, in the paper [22] the authors study the dependence of the level free cash flows in a company on the speed of adjustment to the optimal capital structure by means of introducing corresponding dummy variables for the companies with a low, average and high free cash flow. At the same time, the authors (conscious of the problem of biased least square method estimates) use a corrected least square model with dummy variables (*LSDVC*). In that model, the estimates are coefficients corrected for the value of shifting, and obtained by means of an assessment of the least square model with dummy variables. At the same time, the extent of shifting is assessed by means of more complicated regression models using the generalised method of moments, which will be considered in more detail in the next section. The results obtained by the authors enabled them to define the differences in the speed of adjustment depending on the level of the free cash flow for companies with either excessive or insufficient financial leverage. The obtained estimates confirm the assumption that companies with large free cash flows have a higher speed of adjustment to the optimal capital structure, however, this conclusion describes dynamics of the capital structure only for the companies with the debt level lower than the optimal one. By means of this methodology the authors found out a nonlinear dependence for the companies with an excessive financial leverage in which companies with the largest and smallest free cash flows adjust quicker to the optimal capital structure. Upon that the companies with an excessive level of debt load on the average have a higher speed of adjustment to the optimal capital structure. These conclusions are in line with the results of the research [23] in which the authors revealed a higher speed of adjustment for the companies with bigger absolute values of free cash flows. The companies with larger free cash flows have an opportunity to pay off a part of the debt or to take up shares in the market in order to optimize the capital structure while the companies with large negative cash flows have to resort to outside financing in the form of a debt or joint-stock capital, depending on whether the leverage is above or below the optimal level. Thus, the absolute value of free cash flows of a company may significantly influence the speed of adjustment to the optimal capital structure, the average value of which, as estimated by the author, amounted to 21.9% for the book leverage and to 22.4% for the market leverage.

At the same time, the influence of the value of a free cash flow on the speed of adjustment may be sensitive to the estimation method. So, the existence of a nonlinear link in the paper [22] is confirmed only when a corrected least square method with dummy variables is applied, while use of the generalised method of moments reveals only a linear positive interrelation.

Analysis of the Speed of Adjustment to the Optimal Capital Structure Applying the Generalized Method of Moments

Application of the generalised method of moments (GMM) in order to assess the speed of adjustment to the optimal capital structure is meant to eliminate the problems related to shifting of estimates when using the least square method, and has become one of the most widely used methods of evaluation of the considered models. One of such methods is Arellano-Bond GMM [24], which estimates a model using the first-order differences of variables as tools which makes it possible to eliminate the shifting related to nonobservable special characteristics of companies, even for panels with short time intervals. So, in the paper [25] the authors assess the speed of adjustment to the optimal capital structure for Malaysian companies using Arellano-Bond GMM. In view of the fact that the data panel comprises a large number of companies, but the length of the observation period is limited, this method is the optimal one. The obtained results indicate that the speed of adjustment for Malaysian companies is high enough and amounts to 53%, i.e. the capital structure adjusts to the optimal one in 1.75 years. This result shows that achievement of the optimal capital structure is correlated with serious benefits for companies, therefore, probably, these benefits are greater than those for companies in developed countries in which speed of adjustment is estimated at

lower values. Similar results were obtained in the paper [26] when using Arellano-Bond method of evaluation of the speed of adjustment of the BRICS and Eastern Europe countries. The obtained estimates confirm that in the emerging markets the speed of adjustment is higher than in the developed ones: the estimates vary within the range of 38 to 71%. At the same time in the paper [27] the estimates of the speed of adjustment for USA companies obtained by this method are comparable to the estimates for companies from emerging markets. The speed of adjustment amounts to 48% for the companies conducting their business only in the USA and 54% for companies which are on foreign markets too. Therefore, the higher the level of internationalization of the company, the higher the speed of adjustment to the optimal capital structure. For 10% of companies conducting the major part of their business abroad, the speed of adjustment amounted to 64%. In the paper [28] the speed of adjustment is assessed as 59% and 65% for the book and market leverage of USA companies respectively, in the research [29] it was calculated as 37–40% of the book leverage of Thai companies, in the papers [30] and the abovementioned [25] it was identified as 53% to 57% for Malaysian companies (Table 3).

Table 3. Comparison of Estimates of the Speed of Adjustment to the Optimal Capital Structure Obtained by Arellano-Bond Generalized Method of Moments

Author, year	Country, period	Speed of adjustment, %
Xu, 2007	USA, 1970–2004	Book leverage: 59 Market leverage: 65
Tongkong, 2012	Thailand	Book leverage: 36,9–39,7
Ariff, Taufiq, Shamsher, 2008	Malaysia	Book leverage: 52,90
Haron et al., 2013	Malaysia 2000–2009	Book leverage: 57 Market leverage: 54
McMillan, Camara, 2012	USA, 1991–2009	Market leverage: 48–64
Kokoreva, 2012	BRICS and Eastern Europe, 2002–2010	Book leverage: 38–71

Despite the fact that applying the Arellano-Bond GMM method eliminates the effect of unobservable special effects of companies and biased estimates caused by, it this specification of GMM has serious shortcomings. Inasmuch as Arellano-Bond GMM is based on use of lagged values of variables as tools for their first-order differences the estimates obtained by this method may be shifted significantly in finite samplings if the autoregressive parameter is close to 1. This problem turns up if the studied variable has weak temporal dynamics, i.e. it is not exposed to serious period-by-period deviations [18]; [27]. As part of an assessment of change in level of a company's financial leverage this problem may be especially acute because the capital structure of a company is often rather stable in the year-to-year intervals. For this reason, the assessment of the speed of adjustment by Arellano-Bond GMM may result in a significant shifting of estimates. In this case, if the speed of adjustment is rather low, changes of the financial leverage level, all other things being equal, will also be little, which means that use of Arellano-Bond GMM may result in a significant shift in the estimates of the speed of adjustment.

It is possible to overcome the problem of application of GMM for data with stable dynamics by assessing the set of equations in levels and differences offered in the papers [31] and [32]. When assessing such set of equations the values of differences are used as tools to evaluate an equation in levels, and vice versa – the values of variables are tools to evaluate an equation in differences. The Blundell-Bond generalised method of moments came into common use in empirical studies of the speed of adjustment to the optimal capital structure because it takes into consideration the majority of problems inherent in applying other methods of analysis, and allows us to obtain more reliable estimates.

Thus, in the paper [16] the authors obtained an estimate of the speed of adjustment of the book value of the leverage of American companies to the optimum level of 25%. This estimate is within the range of the estimate obtained by the ordinary least square method and the estimate with fixed effects, which is in line with the expectations around the value of an unbiased estimate of the speed of adjustment. Similar results were obtained in the paper [33], which evaluated the speed of adjustment of companies from 22 developed countries as 23.9 and 22.5% for the book and market leverage respectively. Lower estimates of 15–18% were obtained in the paper [34] for the market value of the leverage and in the paper [28], it is set at 14% and 16% for the book and market leverages. The speed of adjustment of British companies is also comparable to previous estimates and varies in the range of 22–31% [35]. Higher speeds of adjustment for companies from devel-

oped markets were obtained in the paper [22]. Depending on the amount of free cash flows, the speed of adjustment is 47 to 69% for the book leverage and 29 to 57% for the market leverage. Therein, unlike in the corrected least square method there becomes apparent an unambiguous positive relation between the free cash flow level and the speed of adjustment for the companies with and excessive debt as well as with an insufficient debt. In the research [36] the authors consider small and medium Spanish companies and evaluate the speed of adjustment to the optimal capital structure as 24–33% for the companies with excessive and insufficient debt respectively. The obtained results indicate a significantly lower speed of adjustment than the one defined in the paper [22]. A lower speed of adjustment for the companies with excessive debt would seem to contradict previous results. However, in view of the fact that the selection comprises small and medium companies, the dynamics of adjustment may differ significantly from it in the largest companies. A lower speed of adjustment for the companies with large debts may be related to the fact that small companies develop dynamically and the necessity to decrease the debt load reduces over the course of time as a result of the company capitalization growth. An interesting conclusion of this paper is that the dynamics of the capital structure are not aimed at the optimal level for all companies, as in just 52% of companies the capital structure approaches the optimal one.

Analysis of the influence of certain factors on the speed of adjustment to the optimal leverage is of special interest, since these factors are not necessarily limited by the financial indicators of companies. In the paper [37] the author analyzed the influence of affiliation of Japanese companies to large corporate conglomerates (known as 'Keiretsu'). The author made a preliminary conclusion that companies which are part of corporate conglomerates adjust to the optimal capital structure significantly slower than other companies, which is probably caused by close interrelations between the companies and the bank providing services to them. Thus, the speed of adjustment of the companies which are members of Keiretsu groups is 3.7%, while the speed of adjustment of other companies is 11.1%. The degree of shared cross-ownership among the companies also significantly influences the speed of adjustment: for the companies with high cross-ownership the speed of adjustment amounts to 8.2% while for other companies that figure is 20.8%.

An extensive analysis of the speed of adjustment is described in the paper [38] which considers 37 countries with developed and emerging markets, and the obtained estimates of the speed of adjustment therein vary in the range of 4.03–40.61% for the book leverage, and 10.87–52.86% for the market leverage. In general, the obtained results are highly dissimilar and give no opportunity to separate emerging markets from developed ones based on the speed of adjustment criterion. With this background, the authors focus on the analysis of the influence of institutional factors on the speed of adjustment, and this would have enabled them to explain the sources of differences among certain countries. The speed of adjustment in Asian countries was studied in the paper [39] using a selection of 11 countries. The authors got estimates in the range of 24 to 45% for companies from various industry sectors. So, high-tech industries show the highest speed of adjustment, while consumer-goods makers display the lowest. Generally, these results show that companies from the highest-risk sectors prefer to adjust the capital structure to the optimal one quicker, while companies from less risky sectors optimize at a slower rate.

Assessment of the speed of adjustment for Romanian companies made in the paper [40] indicated a rather quick annual reduction of deviation from the target book values of the capital structure, namely 63%, which is somewhat higher than the estimates from the paper [26] for Eastern European countries (30–41%). Therefore, the obtained estimates are comparable because in the paper [26] the results do not depend on the specification of GMM.

Significant studies of the speed of adjustment to the optimal capital structure have been conducted for African countries also. In the paper [41] an analysis of book values of the financial leverage helped to evaluate the speed of adjustment as 57–63%, in the paper [42] it amounted to 56,7%, and in the paper [43] the figure was 59% for long-term debt and 39.6% for joint debt. Similar results of the speed of adjustment when evaluating Nigerian companies were achieved in the paper [44] by including in the ordinary least square method the fixed effects regression obtained when assessing a corresponding model at the first stage. At the same time, an assessment of regressions which applied the Blundell-Bond GMM gave no meaningful results in the same selection of companies, which in its turn prevents a firm conclusion being drawn about the reliability of obtained results (Table 4).

Table 4. Comparison of the Estimates of the Speed of Adjustment to the Optimal Capital Structure Obtained by the Blundell-Bond Generalized Method of Moments

Author, year	Country	Speed of adjustment, %
Caglayan, Rashid, 2014	Great Britain, 1981–2009	Higher TL: 24.5–29.6
		Lower TL: 21.9–31.0
Lemmon et al., 2008	USA, 1965–2003	25

Author, year	Country	Speed of adjustment, %	
Xu, 2007	USA, 1970–2004	Book leverage: 14	
		Market leverage: 16	
Flannery, Hankins, 2013	USA, 1998–2004	15–18% depending on the length of the selection	
Rubio, Sogorb-Mira, 2012	Spain, 1995–2007	Higher TL:	high CF – 69
			medium CF – 54
			low CF – 47
		Lower TL:	high CF – 57
			medium CF – 36
			low CF – 29
Aybar-Arias et el., 2012	Spain, 1995–2005	Book leverage: 24–33	
Brendea, 2014	Romania, 2004–2011	Book leverage: 63	
Yamada, 2014	Japan, 1977–2010	In a Keiretsu group – 3.7, otherwise – 11.1	
		High cross-ownership – 8.2;	
		low – 20.8	
Antzoulatos, Koufopoulos, 2013	22 developed countries, 1990–2010	Book leverage: 22.5–23.9	
Öztekin, Flannery, 2012	37 countries, 1991–2006	Book leverage: 4.03–40.61;	
		medium – 21.11	
		Market leverage: 10.87–52.86;	
		medium – 26.29	
Getzman at al., 2014	11 Asian countries, 1995–2009	Book and market leverage: 24–45 depending on the sector	
Etudaiye-Muhtar, Ahmad, 2015	African countries, 2003–2012	Book leverage: 57–63	
Lemma, Negash, 2013	9 African countries, 1999–2008	Book leverage: 57–63	
Lemma, Negash, 2014	9 African countries, 1999–2008	Book leverage: 56.7	
		Long-term - 59, joint: 39.6	

One of the most widespread modifications of Blundell-Bond GMM is the use of tools with longer time lags, thus enabling one to obtain unbiased estimates of the speed of adjustment in case of a limited selection [45]. Assessment by Blundell-Bond GMM gives an opportunity to use a large number of tools which may adversely affect the accuracy of assessment if the selection contains an insufficient amount of information [18]. Thus, in the considered paper, the authors evaluated the model using long time lags for differences of variables' values. They analyzed the models with different time differences (of 4 to 28 years) and thus managed to obtain the estimates of the speed of adjustment in the range of 17.5–21.1% for the book leverage, and 15.6–22.3% – for the market leverage. These values are within the range of the estimates obtained when evaluating the regression applying the least square method. That is, they confirm the assumption that unbiased estimates of the speed of adjustment are higher than the estimates obtained by the ordinary least square method and lower than the estimates obtained by the least square method with fixed effects. In their research, the authors confirmed this assumption by applying the Monte Carlo method. This revealed a significant dissimilarity of the estimates obtained by the least square methods from the real values of the generated speed of adjustment, while the estimates obtained by the long time lags method virtually replicate the generated values. At the same time, it is important to note that use of this method is limited significantly if the studied data panel is limited, which, in the first instance, is characteristic of emerging

markets where data about companies is accessible only for a relatively small number of years. A similar method of evaluation was used in the paper [22] which assessed the speed of adjustment within 18–42% for the companies with excessive debt and 17 –36% for the companies with a debt level lower than the optimum. The obtained estimates are indicative of a rather high speed of adjustment. However, these estimates are lower than the ones obtained when assessing the system by Blundell-Bond GMM, which conforms to a greater extent to the dynamics of adjustment of the leverage to the optimal level revealed in other developed countries.

Methodologies of Evaluation of the Speed of Adjustment with Data Generation and the Dynamic Model of Evaluation with a Censored Dependent Variable

A great variety of methodologies of evaluation of the speed of adjustment applying different specifications of GMM made it possible to solve, to a great extent, the problem of biased estimates and obtaining reliable results. At the same time, there is no commonly held opinion concerning the most preferable and reliable GMM method. This resulted in alternative methods of evaluation of the speed of adjustment, intended to solve the problem of biased estimates as part of other evaluation procedures. So, in the paper [46] the authors study the speed of adjustment for American companies since 1965 to 2008 using the methodology developed [47]. They assess the speed of adjustment for existing real data applying the ordinary least square method in which the estimates contain some biased value. Additionally, the authors generate another selection (*Placebo sample*) which consists of initial values for financial leverage, to which random changes of debt level or joint-stock capital are added in each period. Thus, the values obtained for financial leverage do not depend on the company's characteristic features. Thus, having assessed a similar model for the generated selection with random deviations of the leverage values, one can get the coefficients which have only the biased value, which emerges when using the least squares method. Then, the difference of the estimates obtained when evaluating each selection will constitute an unbiased estimate of the speed of adjustment to the optimal capital structure.

One of the major deficiencies of this method is the complexity of theoretical justification of the assumption of categorical bias of the estimates obtained from different selections. At the same time, the estimates obtained using the generated selection are close to the estimates obtained applying GMM. The estimates of the speed of adjustment obtained by this method for USA companies amount to 12% for the book leverage value and 14% for its market values. The authors also revealed a positive relation between the value of the company's deviation from the optimal capital structure and the speed of adjustment, and what is more, this dependence is stronger for those companies with excessive debt load.

Another way of assessment of the speed of adjustment to the optimal capital structure was offered in the paper [48]. This methodology is intended for evaluation of unbalanced dynamic panel data which comprise a fractional dependent variable which was called *DPF estimator*. This valuation function is a tobit variable censored on both sides which makes it possible to take into account the limitedness of the financial leverage values in the range of zero to one. In this case the estimate of the financial leverage is the share of debt in the total value of the company capital. The estimate of the speed of adjustment by this method implicates the procedure of data generation which takes into consideration the censored character of the financial leverage data and the evaluated model of partial adjustment takes into consideration existence of fixed effects of each company. Therein, the estimate of fixed effects was obtained as the sum of the initial level of the financial leverage and mean temporal effects of the company special characteristics which influence its financial leverage. The analysis of accuracy of estimates carried out by the author using Monte Carlo simulation revealed that the estimates obtained by the *DPF* method describe the true values of the speed of adjustment much better not only in comparison with the least square method comprising fixed effects, but also in comparison with Blundell-Bond GMM and the method using longer lags of variables in differences. Assessment of the speed of adjustment of the market leverage obtained by this method for USA companies for the period of 1965 to 2010 amounted to 26% which is in the range of the estimates obtained by GMM. The authors also found evidence that companies with significant deviations from the target capital structure have a higher speed of adjustment. Moreover, the higher the company default risk characterized by its credit rating, the quicker it adjusts the capital structure to the optimal level.

This methodology was also applied in the paper [49] which evaluates the speed of adjustment of G7 countries. The obtained results evaluated the speed of adjustment just one percentage point lower than the abovementioned paper, namely as 25%. Further still, the authors compared the estimates obtained by the abovementioned models of the least square method and GMM, the results are presented in Table 5.

Table 5. Comparison of the Estimates of the Speed of Adjustment for Different Evaluation Methodologies [49], %

	OLS	FE	AB	BB	DPF	LD 4	LD
Book leverage	11.3	38.1	27.0	18.2	25.0	23.0	22.4
Market leverage	14.0	42.0	31.4	20.6	31.2	29.5	22.9

Conspicuously, the estimates obtained by the *DPF* method are closer to the estimates obtained in the system GMM with long-term time lags and Arellano-Bond GMM while the estimates of Blundell-Bond GMM are a little smaller than the abovementioned ones. All in all, the estimates obtained by these methods are rather close to each other and are in the middle of the range of estimates derived using the ordinary least square method and the least square method with fixed effects, and this conforms to the expectations as regards the value of unbiased estimates of the speed of adjustment. In emerging markets the *DPF* method of evaluation was applied for the companies listed at the Johannesburg Stock Exchange since 2000 to 2010. The obtained estimate amounts to 54% for the leverage comprising only long-term debt and is consistent with the estimate of Blundell-Bond GMM for African companies. However, at the same time, the speed of adjustment for the leverage comprising joint debt of the company amounted to 80%, which is significantly greater than earlier estimates and brings up the issue that it is necessary to take into consideration short-term debt; and the authors have not found for it a statistical demonstration of existing of the optimal level aimed at by the company.

Research Hypotheses

The results of analysis of the speed of adjustment to the optimal capital structure are highly sensitive to the applied methodology. Thus, empiric studies indicate that application of the least square method results in underestimation of the speed of adjustment and the least square method with fixed effects causes overestimation of obtained estimates. In this case the unbiased estimate of the speed of adjustment should be in the range of the estimates obtained by the abovementioned methods [20]. So, the first hypothesis is phrased as follows.

H1: the estimates obtained by the least square method are underestimated in comparison to the *DPF* method while the estimates of the least square method with fixed effects are overestimated.

The next hypothesis considers influence of the direction of deviation from the target capital structure on the speed of adjustment. Thus, in accordance with the results of the majority of empiric studies it is presumed that companies with excessive debt load will adjust to the optimal capital structure quicker than companies with insufficient debt level [17]; [23]; [22]; [46]. At the same time companies with debt load exceeding the optimal level are greatly limited in the opportunities of equity raising, and the high value of the capital and large interest payments may decrease significantly the company's opportunities of debt repayment. Thus, there are two variations of the third hypothesis:

H2a: estimates of the speed of adjustment for companies with the debt level exceeding the optimal level are higher than for companies with low debt level.

H2b: estimates of the speed of adjustment for companies with the debt level exceeding the optimal level are lower than for companies with low debt level;

Also the distance from the target capital structure influences significantly the speed of adjustment: the more the deviation from the target leverage value, the quicker companies strive to achieve the optimal value [12]; [50]; [51]; [52]; [23]; [53]; [46]; [22]. At the same time a series of papers produced opposite results [54]; [55]; [25], thus, the hypothesis of existence of a positive dependence may be discarded in actual practice. Moreover, the ratio of the value of the company cash flows to the value of the gap between the current capital structure and the optimal one has a significant impact on the speed of adjustment.

The value of the gap covered by the absolute value of the company money flow may be covered at significantly lower expenses, inasmuch as in case of a positive cash flow it is a cheap source of the capital structure optimization, and in case of a negative cash flow the expenses of getting access to the capital market and financial leverage optimization are replaced with the company need in fund raising for its operating and investment activities. In this regard hypothesis 3 if phrased as follows.

H3: the speed of adjustment to the optimal capital structure at the value of deviation from it within the range of the absolute value of cash flow is higher than beyond such range.

At the same time a more detailed division of companies' states according to the ratio of deviation from the target capital structure to the value of cash flow is considered in the part dedicated to the methodology of assessment of a corresponding model.

Research Methodology

Empiric studies of the speed of adjustment to the optimal capital structure constitute a wide range of assessment methodologies. The researches considered before showed that an assessment methodology may produce a critical effect on the obtained estimates. Thus, application of the least square method results in the estimates of the speed of adjustment value shifted downwards. One of the reasons for that is disregard of companies' special features. In its turn application of the least square method with fixed effects results in overestimation of the speed of adjustment due to the endogeneity problem which is caused by introducing lag values of the dependent variable which brings about correlation of balance. In this relation application of the least square method to evaluate the speed of adjustment to the optimal capital structure prevents us from obtaining reliable results, therefore this research is based on use of more advanced evaluation methods, in particular GMM and *DPF*. At the same time verification of the hypothesis of bias of the least square method's estimates is of considerable interest, due to it the results of the least square method model, the GMM model and the *DPF* model will undergo the comparative analysis.

The generalized method of moments also has various specifications and is optimal to assess short data panels inherent in emerging markets, however by reason of the fact that Arellano-Bond GMM may result in biased estimates for data series with stable values of the financial leverage using of system Blundell-Bond GMM is more justified. At the same time use of a modified system GMM with longer lags of variables in differences which has proved to be successful in some papers is more applicable for the data panels with long time lags.

In spite of the advantages of the estimates obtained by GMM over the methodology using the least square method there is a series of material constraints imposed on applicability of this method. In the first instance, one of the most significant drawbacks of GMM estimates is the possibility to obtain estimates of the optimal level of the financial leverage beyond the range of its possible values. So, companies with high profitability levels and a stable financial position may have a very insignificant increase in costs of financial imbalance when debt increases. This may result in a situation where balance between benefits from the tax shield and expenses of financial imbalance is attained when the company liabilities exceed the assets value, i.e. when the leverage value exceeds one which is unreal for a financially sound company. At the same time for companies with a low financial stability the optimal leverage level may be assessed as below zero, however a company is reasonably limited by zero debt load.

In this case the obtained estimates of the optimal leverage level require censoring, i.e. restriction of the assessed values to zero and one. This methodological problem is solved using the *DPF* method which constitutes a tobit model and a two-sided censoring of the evaluated optimal values of the financial leverage. Moreover, the model specification allows to work with unbalanced panel data and takes into consideration the problem of unobservable effects occurrence related to introducing lag variables, hence, it allows to obtain unbiased estimates of the speed of adjustment to the optimal capital structure. In this research the main method of evaluation of the speed of adjustment to the optimal capital structure will be the *DPF* method, however, in addition to it we analyzed the results obtained by using the least square method as well as GMM.

The Partial Adjustment Model

The assessment of the speed of adjustment to the optimal capital structure implicates use of the partial adjustment model. The standard partial adjustment model is described with the following equation:

$$L_{it} - L_{it-1} = \gamma(TL_{it} - L_{it-1}) + \varepsilon_{it}. \quad (1)$$

This formula describes the process of change of the financial leverage where in each period the company financial leverage L_{it} adapts to the optimal value at a speed of γ. At the same time the optimal leverage value is an unobservable variable, however its target level is defined by a set of determinants of the target capital structure X.

$$TL_{it} = \alpha_i + \beta X_{it} \quad (2)$$

Thus, the unobservable target value of the leverage in equation (1) may be defined through determinants of the target capital structure by plugging equation (2) in equation (1), herewith rearrangement of summands helps to distinguish the speed of adjustment to the optimal capital structure γ:

$$L_{it} = (1-\gamma)L_{it-1} + \gamma\alpha_i + \gamma\beta X_{it} + \tilde{\varepsilon}_{it}. \quad (3)$$

The speed of adjustment to the optimal capital structure constitutes a difference in the values of the regression coefficient at the lag value of the leverage variable L_{it-1} and one.

Assessment of the partial adjustment model assumes that the speed of adjustment to the optimal capital structure is homogeneous, i.e. equal for all considered companies.

Equation (3) constitutes a model specification used to evaluate the speed of adjustment applying the least square method. Use of the least square method and other methodologies with fixed effects implies the possibility of taking into consideration the company special characteristics and temporal effects. The model specification for this methodology is represented by equation (4):

$$L_{it} = (1-\gamma)L_{it-1} + \gamma\alpha_i + \gamma\beta X_{it} + \nu_i + n_t + \tilde{\varepsilon}_{it}, \quad (4)$$

where L_{it} – the leverage value at the moment of t; X_{it} – list of determinants of the optimal capital structure; β – estimates of influence of these determinants; γ – speed of adjustment; ν_i – companies' fixed effects; n_t – temporal fixed effects.

In order to assess this specification the generalized methods of moments and the *DPF* method which give more reliable estimates are also applicable.

The Modified Partial Adjustment Model with Heterogeneous Speed of Adjustment: General Specification.

At the same time application of the abovementioned single step procedure prevents us from assessing influence of some determinants on the speed of adjustment to the optimal capital structure. In this regard a need of applying a two-step assessment method arises which is based on the methodology used in the paper [38]. In this paper at the first step unobservable values of the target level of the financial leverage are evaluated using the *DPF* method applied to the model similar to equation (4). Using the obtained coefficient values and values of determinants of the optimal capital structure one may evaluate the target value of the financial leverage for each company. Then, after assessing these values one may calculate the deviation value of the financial leverage from the optimal value $\hat{D}ev_{i,t}$:

$$\hat{D}ev_{i,t} = L_{it} - L_{it-1}. \quad (5)$$

Plugging equation (5) into equation (2) as the deviation value from the target leverage we have the following model specification:

$$L_{i,t} - L_{i,t-1} = \lambda_j(\hat{D}ev_{i,t}) + \delta ij,t. \quad (6)$$

Evaluation of the model specification represented as equation (6) helps to make a departure from restrictions related to the single-step assessment procedure and assessment of the speed of adjustment as an exceptionally homogeneous value. Indeed, the speed of adjustment may depend on a multitude of other factors: in the first instance, the same company financial indicators which define the level of the target capital structure, economic indicators, country or other factors including institutional ones influence it. In this case the speed of adjustment itself is the value defined by some list of determinants and is given by the following equation:

$$\lambda_i = \Lambda Z_{it} + \mu T_{ct} + \tau_t Y_t, \qquad (7)$$

where Z_{it} – list of financial indicators; T_{ct} – list of macroeconomic country indicators; – temporal fixed effects.

At long last, plugging of the variable of the speed of adjustment from equation (7) in equation (6) enables us to have the final model specification (8) which differentiates influence of various determinants on the company speed of adjustment to the target capital structure. Therein, assessment of this model allows to apply the least square method because of absence of dependent variable lags

$$L_{i,t} - L_{i,t-1} = (\Lambda Z_i + \mu T_{ct} + \tau_t Y_t)(\hat{D}ev_{ii,t}) + \delta_{i,t}. \qquad (8)$$

At the same time in view of the fact that assessment of the model is made on the basis of the evaluation results of the partial adjustment model at the previous step it is reasonable to use the least square method and with *bootstrapped* errors – the methodology which helps to leave out any exterior effects brought about by generation of variables for the obtained estimates.

Therein, for the models which use dummy variables as determinants the equation looks as follows:

$$L_{it} - L_{it-1} = \gamma_i \hat{D}ev_{i,t} Dummy_k + \tilde{u}_{it}. \quad (9)$$

The modified partial adjustment model with heterogeneous speed of adjustment: influence of the deviation value and company cash flows

The speed of adjustment to the optimal level of the financial leverage is preconditioned by a broad list of factors and is the result of assessment of potential benefits and expenses caused by change of the leverage level. Undoubtedly, the greater the benefits from achieving the optimal level, the higher the speed of adjustment should be. In this case one of the main factors defining the balance of benefits and expenses from change of the financial leverage level is the distance from the actual level to the optimal one as well as the direction one needs to take in order to optimize the capital structure. Indeed, for companies with the capital structure rather close to the optimal one, especially taking into consideration transaction costs benefits from such adjustment are significantly less than for companies which capital structure is far from the optimal one, hence, the speed of adjustment should be slower. Moreover, the balance of benefits and expenses may be different for companies with excessive debt load and companies with the debt level less than the optimal one, hence, the speed of adjustment may differ significantly depending on the direction of approaching the optimum.

Along with the deviation value and direction the extent of flexibility of the company financial policy may be of paramount importance, and it is in a great measure defined by the value of cash flows it generates. The company cash flows influence significantly the costs of adjustment to the optimal capital structure, therewith, their absolute value is of the main importance [23]. If a company has high positive cash flows it has a cheap source of cash it can use to discharge a debt or redeem shares depending on whether its debt load is insufficient or excessive. On the other hand, a company with high negative cash flows may have great investment opportunities, and this preconditions its tendency to finance its activity by raising debt funds or using its equity capital depending on the ratio of the actual and optimal leverage. In this case raising additional capital covers the company need in financing and provides additional benefits from optimization of the capital structure and decrease of costs of such financing.

Interaction of the factors described above solves the methodological problem related to defining the criteria of the value of deviation from the target capital structure and the value of the company cash flows. In a series of researches criteria of allocation of companies to groups were often defined by the values' getting into some percentile or by another quantitative criterion which has been defined on a rather subjective basis. Correlation of the deviation value with the company cash flows allows not just to eliminate this methodological drawback, but to assess the interrelation of some determinants of the speed of adjustment to the optimal capital structure. Following the methodology offered in the article [23] the research of influence of the deviation value and the company cash flows on the speed of adjustment is conducted using the following model:

$$L_{i,t} - L_{i,t-1} = \{[\gamma_1(|Dev| - |CF|) + \gamma_2 |CF|] \cdot DevL\arg er +$$

$$+[\gamma_3 |Dev| + \gamma_4(|CF| - |Dev|)] \cdot (1 - DevL\arg er)\} \cdot Sign + \tilde{\varepsilon}_{it},$$

$DevL\arg er = 1$, if $|Dev| > |CF|$, otherwise = 0,

$Sign = -1$ for companies with the excess leverage level, otherwise = 1.

Therein, this model comprises four different company states characterized by the following conditions:

$ExcessDev = (|Dev| - |CF|) \cdot DevL\arg er$ – a part of the value of deviation of the actual financial leverage level from the optimal one which is not covered by the company cash flow;

$Overlap|Dev| > |CF| = |CF| \cdot DevL\arg er$ – a part of the abovementioned deviation covered by the company cash flow;

$Overlap|CF| > |Dev| = |Dev| \cdot (1 - DevL\arg er)$ – value of deviation from the optimal financial leverage when the company cash flow exceeds this value;

$ExcessCF = (|CF| - |Dev|) \cdot (1 - DevL\arg er)$ – a part of the company cash flow which exceeds the value of deviation from the optimal leverage.

The first two criteria evaluate the speed of adjustment to the optimal capital structure for the case when the value of the company cash flow is less than the gap between the actual and optimal capital structures. A part of this deviation equal to the cash flows value may be covered at a higher speed because costs of the capital structure optimization decrease due to use of the company proprietary funds when it has positive cash flows or because the company needs additional fund raising when it has negative cash flows. In its turn the part of deviation exceeding the cash flows value should be covered at a lesser speed because the expenses of the capital structure change will be higher.

The last two criteria consider the case when the company cash flow exceeds the value of deviation from the target capital structure. In this case the company has an opportunity to cover the whole gap between the actual and target leverages, hence, the speed of adjustment should be significantly higher. Therein, the value of the cash flow part which exceeds the gap between the actual and target leverage should not influence the speed of adjustment inasmuch as it is no more necessary to optimize the capital structure. Thus, this model allows to decompose the effect caused by the ratio of the value of cash flow and deviation from the target capital structure into the capital structure.

The modified partial adjustment model with heterogeneous speed of adjustment: assessment of influence of financial indicators on the speed of adjustment taking into consideration the deviation distance and the company cash flows

The partial adjustment model taking into consideration the heterogeneity preconditioned by the company financial indicators shows a significant flexibility and allows to assess the extent of influence of determinants of the speed of adjustment not just in the whole interval of the gap between the actual and target leverages, but in its separate parts. In this case model (4) evaluating dependence of the speed of adjustment on financial determinants and model (10) evaluating the speed of adjustment at different ratios of cash flows and deviation values may be combined within one, more complex model.

$$L_{i,t} - L_{i,t-1} = \{[(\gamma_1 + \gamma_{1k} Z_{kt})(|Dev| - |CF|)] \cdot \\ \cdot DevL\arg er + (\gamma_2 + \gamma_{2k} Z_{kt}) \cdot |CF| \cdot \\ \cdot DevL\arg er + (\gamma_3 + \gamma_{3k} Z_{kt}) \cdot |Dev| \cdot \\ \cdot (1 - DevL\arg er \cdot ((\gamma_4 + \gamma_{4k} Z_{kt})(|CF| - |Dev|) \cdot \\ \cdot (1 - DevL\arg er)\} \cdot Sign + \tilde{\varepsilon}_{it} \quad (11)$$

In this case the model helps to assess not only the way some financial indicators influence the speed of adjustment to the optimal capital structure, but also the extent to which they play a pivotal role at the stages of approaching the optimum.

Dynamic Model of Panel Data Assessment with a Censored Dependent Variable – DPF

Significant problems impair assessment of the speed of adjustment to the target financial leverage. They turn up due to imbalance of the data panel, introducing the dependent variable lag, presence of unobservable data heterogeneity and limitation of the range of the financial leverage values. Use of GMM proved to be an effective way of assessment of the speed of adjustment which takes into consideration heterogeneity and imbalance of the data panel, at the same time in no way it takes into account the fact that the dependent variable is limited by a certain range of values which may result in biased estimates [47].

The basis for the *DPF* methodology is the partial adjustment model similar to equation (4) above. The main difference is in specifying the values of the financial leverage variable: the latent unobservable variable defined on the basis of evaluation of equation (12) is used as the dependent variable

$$L_{it}^{+} = \lambda L_{it-1} + \alpha X_{it} + n_i + n_t + \tilde{\varepsilon}_{it}. \quad (12)$$

The latent variable L_{it}^{+} is a theoretical estimate of opportunities of getting a debt by a company and may be beyond the range of zero to one. At the same time, in effect the financial leverage level is usually confined within these limits and may violate this condition only in extreme cases. In view of this the values of the observable leverage level are subject to the following limitation:

$$0 \text{ if } L_{it}^{+} \le 0$$

$$1 \text{ if } 0 < L_{it} < 1 \text{ and } L_{it}^{+} \ge 1 \quad (13)$$

Moreover, use of this methodology for assessment of the speed of adjustment requires taking into consideration the unobservable data heterogeneity, it is done by the aid of specification of the company fixed effects as a variable dependable on the initial level of the financial leverage and mean values of the financial leverage determinants:

$$n_i = \omega_0 + \omega_1 L_{it-1} + \omega_2 E(X_i) + \omega_i. \quad (14)$$

In this research the *DPF* method is the main method of assessment of the partial adjustment models. As the most reliable method of evaluation of the speed of adjustment to the optimal levels of the financial leverage it can replace generalized methods of moments used in other researches for the first step of the model assessment.

Evaluation of the abovementioned models implies adding determinants of the target capital structure. These determinants are financial characteristics of the company which influence its capital structure. Such characteristics are the company profitability, its size, opportunities for growth, tangible assets value, value of capital investments and depreciation, research and development expenses, amount of the company interest payments and tax rates in the economy [56]; [18]; [23]. Also the average or median level of the financial leverage in the industry, GDP and consumer prices growth rate, interest rate in the economy and various interest rate spreads may be taken into consideration. Indexes of shares liquidity may also be considered as the factors influencing the capital structure [57]. See the detailed list and methodology of calculation of each variable in the papers which study the speed of adjustment to the optimal capital structure in Table 6.

Table 6. List and Methodology of Calculation of Determinants of the Optimal Capital Structure in Various Researches

	Getzmann, Rangan, 2014	Etudaiye- Muhtar, Ahmad, 2015	Huang, Ritter, 2009	Rubio, Sogorb-Mira, 2012	Hovakimian, Li, 2011	Faulkender, Flannery, 2012	Flannery, Rangan, 2006
Profitability	EBIT/TA	OpInc/TA	OIBD/TA	ROA	OpInc/TA	EBIT/TA	EBIT/TA
Size	ln(*TA*)	ln(*Sales*)	ln(*Sales*)	ln(*TA*)	ln(*TA*)	ln(*TA*)	ln(TA)
Market opportunities	MV/BV	–	TQ	MV/BV	MV/BV	(B_liab+M_e quity)/ TA	MV/BV
Tangibility	FixA/TA	Δ*FIxA/TA*	NetPP&E/ TA	Δ*FIxA/TA*	PP&E/TA	NetPP&E/ TA	PP&E/TA
D&A	D&A/TA	D&A/TA	–	D&A/TA	*D&A/TA*(*t*-1)	D&A/TA	D&A/TA
Industry leverage	IndMeanLev	–	–	IndMean Market D/E	–	Median D/E	IndMedian B_debt/M_as sets (MDR)
CAPEX/ RetEarnings	Earnings retention rate	CAPEX/TA	CAPEX	–	–	–	–
R&D	–	–	R&D/R&DD	–	R&D/Sales and R&DD	R&D/TA and R&DD	R&D/TA and R&DD
Taxes	–	–	Tax rate	Eff tax rate	–	–	–

Variables Description

The empiric study conducted in this research implicates assessment of the company financial leverage optimal level and influence of some determinants on the speed of adjustment to it. Thus, the variables considered in this research come under several categories, each of them will be analyzed below.

Here we consider the values of the book and market leverages as the financial leverage indexes, and they are defined as follows:

book leverage: $Book\ Leverage = (STD + LTD)/TA$;
market leverage:
$Market\ Leverage = (STD + LTD)/(TA - BV + MV)$,
where STD – short-term debt; LTD – long-term debt; TA – total assets of a company; BV – book value of the joint-stock capital; MV – total market value of a company. We used the following indicators as determinants of the optimal capital structure:

profitability: $Profit = EBIT/TA$;

size: $Size = \ln(Sales)$;

market possibilities: $MtoB = MV/BV$;

depreciation: $DA = D\&A/TA$;

tangible assets: $Tang = FixedAssets/TA$;

investments: $CAPEX = CapitalExpenditures/TA$;

research and development: $RD = R\&D/TA$;

$R\&DDummy = 1$, if there is no RD value

$R\&DDummy = 0$.

Among determinants of the optimal capital structure this research considers the industry value of the financial leverage $IndLev$ defined as the financial leverage median value in each industry group for each separate year and country; the company effective tax rate represented by the variable Tax as well as macroeconomic factors: nominal GDP growth rate and inflation rate in percent represented by the variables GDP and $Inflation$ respectively. Introducing of the dummy variable indicating absence of research-and-development expenses is explained by the fact that for the majority of companies there is no information as regards these expenses. However, in order to preserve the completeness and representativeness of the selection the value of research-and-development expenses is placed with zero for these companies while introducing the dummy variable prevents the possible bias of the influence estimate preconditioned by this replacement.

The financial indicators of a company can influence not just the value of the optimal financial leverage, but also the speed at which the company strives to attain it. The inducements to optimize the capital structure may differ for companies of various sizes, profitability or different opportunities to economize using the tax shield. Thus, the determinants of the speed of adjustment analyzed in this research are represented by the same financial and economic indicators which are used to define the optimal financial leverage.

At the same time in addition to the abovementioned indicators we considered various states of deviation from the target capital structure and their correlation with the company cash flows. In this case the additional indicator is the cash flow which value is defined in accordance with the methodology offered in the paper [23]:

$$CF = \frac{EBITDA - TaxExpenses - IntereseExpenses}{TA} - \\ - Industry\frac{Capex}{TA}. \quad (15)$$

The first part of this equation is the definition of the company financial deficit analyzed in the article [58]. At the same time following this methodology it is more relevant to consider instead of capital expenditures the capital investment level in the industry sector in general, inasmuch as unlike the companies' special indicators the industry sector value depicts better the investment opportunities inherent in this business and it is not susceptible to the influence of company decisions as regards raising additional capital. In the last case there is a high probability of facing the problem of endogeneity of the choice between capital expenditures and financial leverage change, hence, use of industry sector indicators as a proxy for the company investment opportunities is justified.

Selection

The selection studied in this paper is represented by public companies of the BRICS countries which do not belong to the financial sector or the basic services sector. The selection comprises data for 2,795 companies within the period of 2005 to 2015 which constitutes 30,745 observations. Taking into consideration the necessity to use lag variables this selection covers effectively a decade of the company financial indicators. Therein, the selection was restricted to the companies with the total assets exceeding 150 million dollars as well as shares marketing quotations - at least by the middle of the observed period, i.e. as of 2010. These criteria are to a greater extent preconditioned by technical constraints which expand over the available selection size, at the same time the objectives set in the paper are not linked to the types of the companies represented in the selection and may be studied for companies of any size (Table 7).

Dispersion of the number of companies over countries is irregular, and the overwhelming majority of observations is represented by Chinese companies. One fifth of the selection is composed of Indian companies while the other BRICS countries comprise a little over 10%.

Dispersion of companies over industry sector groups in the selection corresponds to the standard of global industry sector classification and the industry average indicators were calculated in accordance with this classification. Dispersion of companies over industry sectors is more regular, at the same time the majority of companies is concentrated in the basic industry sectors such as manufacture of materials, basic goods and production sector (Table 8).

Table 7. Dispersion of the Selection of Companies and Number of Observations over Countries

Country	Number of companies	Number of observations	Share in the selection, %
Brazil	118	1,292	4.2
China	1,923	21,138	68.8
India	563	6,187	20.1
Russia	88	966	3.1
Republic of South Africa	103	1,131	3.7
Total	2,795	30,714	100

Table 8. Dispersion of the Selection of Companies and Number of Observations over Industry Sectors

Sector	Code	# of observations	Share, %
Power industry	10	1,154	3.88
Materials	15	6,493	21.83
Production sector	20	7,531	25.32
Selective demand consumer products	25	5,671	19.07
Staple consumer products	30	2,723	9.16
Healthcare	35	2,199	7.39
Information technology	45	3,650	12.27
Communication services	50	317	1.07

Table 9. Descriptive Analysis of Variables in the Whole Studied Selection

Variable	Obs		Mean	Median	Std. Dev.	
BLEV	27 713		0.2558	0.2398	0.1975	
MLEV	27 710		0.2142	0.1536	0.2037	
Profit	27 666		0.0717	0.0605	0.1082	
MtoB	25 042		2.1433	1.5951	2.2872	
Sales		27,952	1,606.04		265.65	9,879.47
DA		26,872	0.0287		0.0246	0.0216
Tang		27,696	0.3374		0.3119	0.2051
CAPEX		27,107	0.0693		0.0502	0.0669
RD		30,721	0.0099		0	0.6397
RDD		30,721	0.4700		0	0.4991
Book IndLev		30,659	0.2432		0.2290	0.0923
Market IndLev		30,515	0.1780		0.1529	0.1064

Variable	Obs	Mean	Median	Std. Dev.	
IndCAPEX	30,627	0.0538		0.0484	0.0242
Tax	23,982	24.41%		19.78%	47.04%
GDP	30,721	14.88%		13.83%	10.24%
Inflation	30,721	4.25%		2.80%	2.89%

Table 10. Descriptive Analysis of Mean Values of Variables Broken Down by Countries

	Brazil	China	India	Russia	Republic of South Africa
BLEV	0.2937	0.2379	0.3301	0.2942	0.1683
MLEV	0.2548	0.1891	0.3072	0.3101	0.1245
Profit	0.0770	0.0609	0.0939	0.1172	0.1296
MtoB	1.7269	2.3088	1.7445	1.3154	2.1777
Sales	3,580.31	1,299.76	1,277.93	6,976.25	2,320.63
DA	0.0366	0.0266	0.0299	0.0433	0.0405
Tang	0.3018	0.3305	0.3604	0.4276	0.3304
CAPEX	0.0650	0.0645	0.0887	0.0790	0.0691
RD	0.0020	0.0081	0.0208	0.0008	0.0010
RDD	0.4374	0.4592	0.4803	0.6553	0.4960
Book IndLev	0.2903	0.2234	0.3128	0.2801	0.1514
Market IndLev	0.2336	0.1460	0.2710	0.2976	0.1007
IndCAPEX	0.0520	0.0482	0.0695	0.0718	0.0605
Tax, %	30.46	21.58	31.46	32.05	34.71
GDP, %	10.84	17.23	10.57	9.72	3.43
Inflation, %	5.89	2.80	7.72	9.65	6.00

All financial indicators considered in this research were taken from the *Bloomberg* database, therewith each value was nominated in million dollars and presented for a calendar year in order to provide data comparability.

The macroeconomic data used in the research have been obtained from the databases of the International Monetary Fund and represent a percentage change of nominal GDP in US dollars and growth rate of consumer prices in each country.

As we see from table 9 the mean value of the book leverage in the selection amounted to approximately 26% of the total value of the company assets which is about 4 pp less than the market leverage value. Therein on the average the book debt load in India, Russia and Brazil is at the comparable level of 29–33% which is higher than that of companies from China approximately by 6 pp and almost twice as large as that of companies from the Republic of South Africa. There is also a larger gap between the market leverage values of these countries' groups which indicates a comparatively greater debt load of companies from India, Brazil and Russia. Comparison of companies by financial indicators is also of a particular interest. So, Chinese companies on the average are less profitable than those of the other BRICS countries, therewith the ratio of their market capitalization to the book value of the joint-stock capital shows that their opportunities for growth are evaluated significantly higher than in other countries.

Analysis of table 10 shows that the average size of a company in Russia is several-fold larger than in the other BRICS countries which indicates a strong concentration

of companies' market share in the economy. India demonstrates the largest share of research and development expenditures among the analyzed economies and Russia, in its turn, is characterized by the largest share of tangible assets in the general structure of company assets. Proximity of values of the effective tax rate for all economies except for the Chinese one where the effective tax rate is approximately one third lower is of interest.

It should be noted that individual companies or years of observations with extreme or inadequate values of variables were excluded from the selection. Keeping of these exclusions in the selection could have influenced significantly the accuracy of the obtained results, in consideration of that we analyzed dispersion of variables' values and their exclusion in case of their serious deviation from the main dispersion interval and absence of a large-scale deviation.

Research Results

Comparative Analysis of Methodologies of Assessment of the Speed of Adjustment to the Optimal Capital Structure

In the first instance within this research we considered the issue of susceptibility of the results of assessment of the speed of adjustment to the methodology used. A review of researches evaluating the speed of adjustment showed that methodology influences significantly the assessed value, what is more, the difference for comparable countries and observation periods may be extremely high.

At the same time the issue of the selection homogeneity and possibility to assess companies from different countries within one general model rises. In this relation we verified the possibility to consolidate data concerning the BRICS countries into one selection using the Chow test. The test results showed that it is impossible to consolidate all countries into one selection either for specification with the book leverage, or for the specification with the market leverage. At the same time a paired analysis of the possibility of consolidation of some countries' sub-selections showed that in some considered countries influence of explicative variables on the financial leverage values is comparable and may be assessed within one model. Thus, for the book leverage model the data for Brazil, Russia and India are comparable against each other in each pair and Chinese data may be evaluated together with the data for Brazil and Russia. The paired Chow test showed that the only exclusion is the Republic of South Africa which data cannot be assessed with any other country in the selection and the estimates of the model for Chines companies are not comparable to the conclusions of the model for Indian companies. Similar results were also obtained for the specification of the model assessing the market leverage value. Thus, test results indicate a clear separation of the selection into two groups: data for Russia, India and Brazil may be evaluated within one selection while data for Chinese companies are comparable to data for South African companies.

Assessing the possibility to consolidate various countries within one selection it is necessary to take into consideration the specification of the regression model used to evaluate the selection. The result of the Chow test implicates use of *ESS* values obtained when assessing the through model of the least square method, however, introducing lag variables and impossibility of taking into consideration unobservable special effects of a company within one model results in biased and inconsistent estimates, hence, this test cannot show reliably whether the assessment results for different sub-selections are comparable. In this case inconsistency and bias of estimates lead to the fact that the results of the least square method assessment for different sub-selections may be far apart or even contradict each other, hence, one cannot assert for sure that it is impossible to assess some countries within one group. Analysis of the Chow test validity for dynamic models including those with short time periods and a large number of explicative variables conducted in the articles [59] [60] also indicates that there is a possibility of a significant positive bias of the Chow test and its susceptibility to endogeneity of explicative variables. However, the actual results of evaluation of the speed of adjustment and influence of the capital structure determinants on the financial leverage in this paper are indeed indicative of significant differences between the selection countries, therefore each used model was assessed applying sub-selections of companies from the same country.

Getting back to the comparison of applicability of various models, analysis of the results obtained by using different methodologies shows significant differences in the value of the estimate of the speed of adjustment (Table 11 and 12).

Table 11. Evaluation of the Speed of Adjustment of the Book Leverage for Various Methodologies

BLEV	OLS	FE	AB	BB	DPF	*LD*(5)	*LD*(2)
Brazil	13.9	50.4	73.5	33.5	31.1	17.4	25.0
China	24.4	57.5	61.4	49.4	45.1	21.0	11.8
India	16.1	58.3	57.2	38.1	33.2	24.8	39.1
Russia	12.6	46.1	59.4	28.3	9.4	18.2	–0.8
Republic of South Africa	17.6	63.4	61.9	48.4	45.6	26.6	24.9

Table 12. Evaluation of the Speed of Adjustment of the Market Leverage for Various Methodologies, %

MLEV	*OLS*	*FE*	*AB*	*BB*	*DPF*	*LD(5)*	*LD(2)*
Brazil	30.9	70.5	98.8	60.9	59.1	–6.9	25.2
China	54.6	84.2	100.0	91.6	79.1	30.9	23.9
India	25.6	74.3	105.0	63.9	59.0	23.7	48.8
Russia	40.1	81.7	100.7	90.8	73.9	24.5	22.7
Republic of South Africa	24.0	71.1	81.9	60.4	62.9	–1.9	35.1

Hypothesis *H1* on undervaluation of the estimates obtained by the least square method and overestimate of the estimates obtained by the least square method with fixed effects is confirmed for both specifications of the financial leverages. On the average the difference in the assessed speed of adjustment is almost three-fold for the book leverage (16.9 against 55.1%) and two-fold – for the market leverage (35 against 76.3%). Moreover, the estimates obtained using the least square method are also sometimes inconsistent. The estimates obtained by Arellano-Bond GMM are, on the average, 7.6 pp higher for the book leverage and 20.9 pp higher for the market leverage than the estimates of the least square method with fixed effects. The estimates obtained by Blundell-Bond GMM in general demonstrate a high stability for the book leverage: they are in the range of the estimates obtained by the least square method and the least square method with fixed effects and are very close to the mean values in all methodologies, however for the market leverage Blundell-Bond GMM showed the estimates beyond this range for China and Russia assessing the speed of adjustment approximately as 90%. The *DPF* method used in this research showed the most stable and reliable results: the speeds of adjustment obtained by this method are the most close ones to the mean values and are in the range between the estimates of the least square method and the least square method with fixed effects which may be considered top-bottom landmark values for reliable values of the speed of adjustment estimates. The only exception is the market leverage model for Russian companies where this method assessed the speed of adjustment at a very low level which, probably, is indicative of susceptibility of the method to the selection size because for Russian companies the number of effective observations turned out to be the smallest. Estimates of the speed of adjustment of the book leverage obtained by Blundell-Bond GMM and *DPF* methods are very close and may be considered equivalent while for the market leverage the only applicable method is the *DPF* method. Estimates of the system GMM with longer lags (in this research two- and five-years lags were used) considered in a series of papers as the most reliable ones in comparison with Blundell-Bond GMM showed the most unstable results, in some cases indicating distancing of companies from the leverage target value which makes them inapplicable for this selection. All considered models have been assessed taking into consideration temporal effects, and all obtained estimates of the speed of adjustment except for some specifications of Arellano-Bond GMM are of relevance even at the 1% level.

Analysis of Influence of the Direction of Deviation from the Target Capital Structure on the Speed of Adjustment to the Optimal Capital Structure

The speed of adjustment to the optimal capital structure should depend to a great extent on the value of deviation from the target level as well as on the direction of deviation. The resolution on optimization of the capital structure is taken in accordance with the evaluated benefits and expenditures of such adjustment. If the existing company structure is close to the optimal one the company benefits from its optimization may be significantly lower than the expenditures incurred when raising new capital and often comprising a fixed part. If the deviation from the optimal capital structure is serious the company benefits from its optimization are significantly larger, hence, the speed should be higher. Moreover, the benefits balance may differ significantly for companies with the debt level higher than the optimal one than for companies which need to increase their debt load. Differences in the speed of adjustment for companies with the debt load exceeding the optimal one and for companies with a lower debt level were assessed using the partial adjustment model with dummy variables. Its general specification is represented by equation (9).

The obtained results indicate that companies with the debt load lower than the optimal one approximate the optimal capital structure at a significantly higher speed than companies with excessive debt load. The speed of adjustment of the leverage book values for companies with excessive debt load amounts approximately to 14–18% which is 2-3 times slower than for companies with insufficient debt load. Differences in the speed of adjustment for market values are less obvious and on the average amount to about 60%. The greatest differences between the considered categories of companies are observed for Chinese companies when assessing the book leverage model where the difference in the speeds of adjustment is almost five-fold while the speed of adjustment of the market leverage for Brazilian companies of various categories is almost equal.

Table 13. Evaluation of the Speed of Adjustment of the Book Leverage for Companies with the Debt Level Higher and Lower than the Optimal One (Equation (9))

BLEV	Brazil	China	India	Russia	Republic of South Africa
Overlevered	0.1467***	0.1801***	0.1499***	−0.2722**	0.1822***
Underlevered	0.3615	0.8532***	0.4019**	0.2592	0.6288***
_cons	0.0343***	0.0165***	0.0294***	−0.0414*	0.0175***
N	669	14,067	3,364	540	815
R^2_{adj}	0.0817	0.278	0.0999	0.1316	0.1261

* p<0.1; ** p<0.05; *** p<0.01.

Table 14. Evaluation of the Speed of Adjustment of the Market Leverage for Companies with the Debt Level Higher and Lower than the Optimal One (Equation (9))

MLEV	Brazil	China	India	Russia	Republic of South Africa
Overlevered	0.3987***	0.5724***	0.3469***	-0.2740***	0.2628***
Underlevered	0.4558**	0.8173***	0.5850***	0.1897**	0.5547***
_cons	0.0358***	0.0065***	0.0324***	-0.0457***	0.0112***
N	669	13,972	3,364	540	815
R^2_{adj}	0.3073	0.5742	0.3053	0.0418	0.2234

* p<0.1; ** p<0.05; *** p<0.01.

This difference in the speeds of adjustment rejects suggested hypothesis *H.3*a stating that deviation from the target capital structure towards excessive debt load is assessed by a company as a more unfavourable state, hence, the speed of adjustment to the optimum will be higher. The obtained result stems from the fact that companies can increase the debt load rather easily while the debt load is lower than their optimal level. In this case creditors are ready to provide loans much easier, hence, companies are able to increase debt up to the optimal value at a rather high speed. At the same time at excessive debt load it may be difficult to raise funds from an investor and debt repayment using the cash flows generated by the company usually takes plenty of time. In this case the assessment results once again indicate that the speed of adjustment depends not just on the company wish to optimize its capital structure on the basis of the balance of benefits and expenditures caused by deviation, but also on external constraints imposed both by the opportunity to use equity or debt capital and by the speed of converting such an opportunity (Table 13 и 14).

At the same time assessment of the model for Russian companies demonstrates conflicting results: companies with excessive debt load level move away from the optimal capital structure rather than approach it, and this contradicts the hypothesis on a company striving to optimize the capital structure. It should be noted that this effect is observed solely for companies with excessive debt level which may occur due to a large-scale decrease of the company assets' cost or of their market capitalization while debt liabilities stay unchanged. There is a high probability that the economic shock of the end of 2014 influenced reliability of the obtained results. As a consequence of the shock, a drop in the market capitalization and in asset value denominated in roubles caused a dramatic discrete leap of the financial leverage for the companies which obligations were nominated in foreign currency. This could result in wrong conclusions as regards companies' moving away from the optimal capital structure. However, limitation of observations to the period ending in 2013 for this model yields no substantial results. It indicates that temporal effects taken into consideration when assessing the model at the previous step could not take into complete account the influence of the domestic currency devaluation on dynamics of the company financial leverage values, and assessment of data for Russian companies requires application of the model specifications adapted for this objective.

All in all the considered models showed a significant explanatory power which varies within the range of 22–57% for the market leverage, however, for the book leverage model the values of R^2_{adj} amounted to just 8–13% except for Brazil where this indicator equaled 28%.

Table 15. Evaluation of Influence of the Value of Deviation of the Book Leverage from the Optimal Value and the Company Cash Flow on the Speed of Adjustment to the Optimal Capital Structure (Equation (10))

BLEV	Brazil	China	India	Russia	Republic of South Africa
			Higher than the Optimal Level		
$ExcessDev$	0.2270***	0.3072***	0.2427***	−0.1579**	0.2343***
$Overlap\ \|Dev\| > \|CF\|$	0.1665	0.6706***	0.6884***	−0.8161**	0.4125***
$Overlap\ \|CF\| > \|Dev\|$	0.3624**	0.6023***	0.5477***	−0.4936***	0.2862***
$ExcessCF$	0.0419	0.1536***	0.2992***	−0.0839	−0.0192
_cons	0.0568***	0.0684***	0.0799***	−0.0565**	0.0443***
N	537	9,997	2,870	436	635
R^2_{adj}	0.1091	0.2226	0.1682	0.2442	0.1354
			Lower than the Optimal Level		
$ExcessDev$	1.097	1.0244***	0.8462***	0.199	0.9314**
$Overlap\ \|Dev\| > \|CF\|$	−0.4269*	0.5763***	0.3879	−0.3647	1.0675***
$Overlap\ \|CF\| > \|Dev\|$	0.1434	0.8250***	0.6632***	−0.0017	1.1499***
$ExcessCF$	0.1356*	0.1985***	0.1378***	−0.2447	0.1717***
_cons	−0.0097	−0.0252***	−0.0193***	0.0177	−0.0319***
N	68	2,946	474	62	157
R^2_{adj}	0.7006	0.7141	0.4174	0.0154	0.4537

* p<0.1; ** p<0.05; *** p<0.01.

Analysis of Influence of the Value of Deviation from the Target Capital Structure and the Company Cash Flow on the Speed of Adjustment to the Optimal Capital Structure.

Studying benefits and expenditures of capital structure optimization it is necessary to take into consideration the absolute value of the company cash flows which influence significantly expenditures of adjustment. If a company has high positive cash flows they may be a cheap source of debt repayment or shares redemption which reduces expenditures of the financial leverage significantly. On the other hand, if a company has negative cash flows it faces the necessity to finance them, hence, it may optimize its capital structure by choosing a corresponding source of raising capital: borrowed or equity one.

Analysis of the ratio of the gap amount to the company cash flows showed that the value of deviation from leverage optimal level also influences significantly the speed of adjustment to the optimal capital structure. Alongside this, the estimates obtained for the considered companies selection in some cases differ from the ones obtained when assessing a similar model for American companies. The results also differ for various countries within the considered selection which suggests different interrelations between the speed of adjustment and the ratio of the company cash flows to the deviation from the optimal leverage.

The considered models show the values of the speed of adjustment comparable to the estimates obtained at earlier stages of the research. Therein for companies from the majority of countries the obtained estimates coincide with the expected interrelations between the value of flows and the capital structure to the speed of adjustment gap. However, as in the previous step the estimates for Russian companies show contradicting results and may not be interpreted true to fact within analysis of the model we consider. Exceedance in some cases of coefficients of unit values is not a critical contradiction to the logic of the partial adjustment model and is most probably an inaccuracy which occurred when assessing the coefficients close to one (Table 15).

In case the gap between the current leverage and the optimal one exceeds the absolute value of the cash flow, companies from China, India and the Republic of South Africa strive to cover the gap value quicker within the amount of their cash flow ($\gamma_2 : Overlap|Dev| > |CF|$), while they

cover the remaining part ($\gamma_1 : ExcessDev$) at a significantly lower speed, and this accords with suggested hypothesis *H.4*. For companies from Brazil this effect is observed exceptionally for the market value of the financial leverage while for the book leverage the coefficient (γ_2) turned out to be insignificant. At the same time this conclusion suits only companies with excessive debt load, and for companies with the debt level lower than the optimal one influence of the cash flow value in case of a greater deviation from the optimal leverage, analysis shows weaker and more unstable interrelations. Conclusions of Chinese companies with the leverage level lower than the optimal one to some extent contradict the logic which asserts that companies cover the gap up to the amount of the cash flow at a greater speed than in case of the deviation which exceeds the cash flow. This result indicates that in case of deviation of the financial leverage from its optimal value for the value exceeding the cash flow, companies, in the first place, tend to cover the gap which exceeds the value of their cash flows, and for the gap within this value the speed of adjustment slows down. All in all, it shows that companies, most probably, are not prone to use all their cash flow to optimize the capital structure in case the debt level exceeds the optimal one. It stems from the necessity to use a part of the flow for the purposes not related to the capital structure optimization. Moreover, in case of a positive cash flow companies may have no need to raise additional debt and shares redemption is substantially restricted if they are overestimated in the market, hence, a company, most likely, will not cover the gap in the capital structure for the whole cash flow amount. On the other hand, if it is necessary to finance negative cash flows a company may be significantly restricted in its choice of the financing sources, which may adversely affect the value of the speed of adjustment. Moreover, these companies may choose the capital sources not just on the basis of the purpose of the capital structure optimization, but probably, on the basis of other considerations, such as retaining control, share of ownership or other motives not related to the considered task (Table 16).

Table 16. Evaluation of Influence of the Value of the Market Leverage Deviation from the Optimal Value and the Company Cash Flow on the Speed of Adjustment to the Optimal Capital Structure (Equation (10))

Higher than the Optimal Level

MLEV	Brazil	China	India	Russia	Republic of South Africa
$ExcessDev$	0.5821***	0.8072***	0.5024***	−0.2531***	0.3397***
$Overlap\ \|Dv\| > \|CF\|$	0.6475***	0.8319***	0.7459***	−0.4820***	0.4519***
$Overlap\ \|CF\| > \|Dev\|$	0.3988	1.1963***	0.8115***	−0.5320***	0.3954***
$ExcessCF$	0.3897***	0.4991***	0.4988***	−0.0399	0.0696**
_cons	0.0946***	0.0972***	0.1130***	−0.0544***	0.0418***
N	447	7,412	2,428	390	558
R^2_{adj}	0.3593	0.5375	0.2658	0.0442	0.1814

Lower than the Optimal Level

MLEV	Brazil	China	India	Russia	Republic of South Africa
$ExcessDev$	0.8745**	1.0047***	0.6795***	-0.1881	1.0554***
$Overlap\ \|Dev\| > \|CF\|$	−0.1166	0.1868**	0.183	−0.2684	−0.3383*
$Overlap\ \|CF\| > \|Dev\|$	0.239	0.9825***	0.5829***	−0.291	0.2398*
$ExcessCF$	0.2213	0.3301***	0.2105***	−0.027	0.1150***
_cons	−0.0308	−0.0396***	−0.0281***	0.0468	−0.0105
N	158	5,461	916	108	234
R^2_{adj}	0.339	0.6498	0.2354	−0.027	0.5664

* p<0.1; ** p<0.05; *** p<0.01.

When the cash flow exceeds the gap amount in the capital structure companies are potentially capable to cover this gap virtually instantaneously by repaying the debt or redeeming shares when the flow is positive and by using equity or borrowed capital when the flow is negative. The results of assessment for the book leverage indicate that the speed of adjustment ($\gamma_3 : Overlap|CF| > |Dev|$) for these companies is comparable to the case of adjustment for the cash flow amount when the latter is lower than the gap amount (γ_1), hence, optimization is of the same importance for the book capital structure of these companies as for the companies which do not cover this deviation with their cash flow. At the same time considering the capital structure assessed for market values, companies from China and India with the excessive debt load level indeed demonstrate the highest speed of adjustment, and this confirms the hypothesis that companies with the cash flow exceeding the gap amount in the capital structure should have the highest speed of adjustment. For a company with insufficient debt level the speed of adjustment is also rather high but comparable to the coefficient (γ_1) as in the case of the book leverage analysis.

Coefficients of the last indicator ($\gamma_4 : ExcessCF$) are rather low and often insignificant. This confirms the assumption that a company strives to preserve the optimal capital structure when it attains it. Differences in the speed of adjustment for companies with the debt load higher and lower than the optimal one in general are not high, it is indicative of equal significance of the optimization objective irrespective of the necessary direction of change.

Al in all the analyzed models demonstrate a high explanatory power, therewith models for market leverage values on the average explain a greater variation than models for the book leverage. It is interesting that with a significant amount of insignificant variables models for companies with the debt level below the optimal one on the average have a higher value of R^2_{adj} , hence, exceedance of the deviation value over the flow value or exceedance of the flow over the deviation which is of significance in the absolute majority of cases plays an important part in taking decisions as regards optimization of the capital structure.

Conclusion

The research results indicate that companies in developing economies are prone to adjust quicker to the optimal capital structure at the financial leverage below the optimal one while companies with excessive debt load conduct optimization much slower.

Also, the cash flow of a company influences significantly the speed of adjustment. Thus, for companies with the deviation from the target capital structure exceeding the cash flow absolute value the speed of adjustment is significantly higher when the gap is covered up to the amount of the cash flow, while the deviation exceeding this value is covered at a much slower speed. At the same time for companies with the cash flow exceeding the deviation from the target leverage the speed of adjustment is the same as for the abovementioned companies when they cover the gap up to the cash flow value. Additionally, during the research we conducted a comparative analysis of various methodologies of assessment of the speed of adjustment to the optimal capital structure and this enabled us to choose the most applicable and effective assessment methods. Analysis of the results for various specifications of the partial adjustment model and time sub-selections also showed a significant sustainability of results. At the same time in some cases the assessed model prevents us from obtaining reliable results for the selection of Russian companies. Analysis of the speed of adjustment, depending on the direction of deviation and its ratio to the company cash flows showed unstable results for the selection of Russian companies, and this means that it is necessary to review models of determinants of the optimal capital structure and assessment of the deviation value from it for analysis of the speed of adjustment for Russian companies.

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