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Do Investors Pay Yield Premiums on Green Bonds?

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Do Investors Pay Yield Premiums on Green Bonds?

Abstract

Global shifts in perspectives on environmental concerns and the growing significance of large-scale sustainability programs have brought the issue of green financing to the fore of financial research. In terms of volume, this area has demonstrated high growth rates in various types of capital markets.

Unfortunately, few studies exist which explore the yields on green bonds in emerging markets in comparison to developed ones. As such, in this paper, we contribute new evidence to the field of green financing and outline several major differences between green issues in these types of capital markets.

We study yield premiums of green bonds on a sample of 2,450 green issues and comparable traditional bonds over the period from 2008 to March 2020. We contribute to the literature by new empirical evidence on green financing.

Our results provide evidence of small but statistically significant negative premiums on green bonds of 23,4%¹ compared to the expected yields for standard issues. We also show that the negative premium on green bonds is more pronounced in developed markets (- 27%²) than in emerging ones (18%³). Moreover, we provide new evidence on the negative premium-liquidity relationship. Our research concludes that negative premiums are related to a higher level of liquidity: green bonds have lower bid-ask spreads and a higher level of liquidity than traditional ones.

These conclusions can assist investors, potential issuing companies, and public authorities in achieving a better understanding of the current situation of the green bond market in global terms.

Key words: green bonds, bond market, negative premium, environment

JEL classification: G32, G12, F01, F21, F64

¹ Interpretation of results in percent because of the logarithmic application of the dependent variable in the econometric model.

² Interpretation of results in percent because of logarithmic application of the dependent variable in the econometric model.

³ Interpretation of results in percent because of logarithmic application of the dependent variable in the econometric model.

Introduction

Due to the acute contemporary significance of environmental issues, investments in projects which mitigate environmental risks have grown increasingly relevant. Issues around 'green bonds' naturally complement strategy aimed at mitigating the consequences of climate change. This is especially the case in relation to the Paris Climate Agreement, which established new obligations for countries related to investments in the area of decarbonisation. Environmental issues are of special relevance for emerging countries where, according to estimates, annual investments of 3 trillion US dollars will be required for the period of 2016 to 2030 in order to migrate to low-carbon economies.

In comparison to the various types of traditional bonds, the specifics of green bonds (in terms of their profitability as well as their marketability) has become an important focus of investment evaluation. From 1st July 2020 on, approximately 2,500 investment funds - those which have signed the UNO Principles for Responsible Investment - will have to invest about a half of the total amount of assets under their control, equaling approximately 45 trillion US dollars.

The existing academic research dedicated to the problems of green bonds yield generally focus on aspects such as the existence of the yield premium in the green bond market, the influence of the issue of these specific bonds on the issuer's shares price, and the presence of correlation of the bond market with other segments of the financial market [1; 2; 3; 4]. However, the rapid development of this market, as well as an increase in the number of issues in recent years, pose the problem of identifying the specific and consistent patterns of yield generation for these issues. The majority of research has been conducted using data from 2017-2018 and pertains to the period when the market for these specific bonds was at the stage of brisk growth. However, now the period of transition to the maturity stage is taking place. Moreover, the existing research is mainly dedicated to the green financing markets in developed countries, while emerging markets are discussed in academic papers very little. As such, there is a significant gap in the current academic literature.

The key motives of this research are related to the problems of price formation for green issues of corporate bonds. Are there yield premiums for green bonds or, on the contrary, are discounts made? Are there any differences in generating yield in the green bond markets in comparison to traditional issues? In which type of capital markets - e.g. those of developed or emerging countries - is this tendency most pronounced? Are there differences in liquidity level of green bonds in comparison to traditional bonds? The empirical evidence and results generated through our evaluation of the above problems represent a significant contribution to the academic literature in this area.

The article structure is as follows. In section 1, we consider the trends of the green bond market. Our review of existing academic research is presented in section 2. Section 3 is dedicated to the construction of our analytical model and the hypotheses of the research. In section 4 we outline our analysis of the results and present our conclusions.

Trends of the Green Bond Market

Definition of Green Bonds and the Main Criteria for their Issue

Green bonds are bonds whose proceeds are wholly or partially used to finance or refinance environmental projects and which comply with the principles stated in the ICMA 'Green Bond Principles' document⁴. Among other principles, apart from the designated purpose of the proceeds of green bonds, the ICMA document evaluates the procedure of analysis of permissible projects and the criteria of their sample, and describes the management of proceeds from green bond issues and public disclosure of information. The Green Bond Principles document distinguishes several extensive areas of projects which may be financed by means of green bonds issue, such as mitigation of climate change, adaptation to climate change, conservation of natural resources and biodiversity, prevention of pollution, and pollution control measures.

The stated criteria indicated in the Green Bond Principles contribute significantly to a better understanding by investors of the specific project's exposure to climatic risks and its potential impact on the environment.

However, not all financed environmental projects may be classified as green projects. There is no unanimous approach in the market to defining green bonds, the criteria of their estimate and taxonomy, and apart from the Green Bond Principles there is also the Climate Bond Initiative (CBI). The document issued by CBI Climate Bond Taxonomy⁵ outlines the division of projects into areas and their classification. In accordance with these divisions, one can identify whether a project meets the purpose of reducing global warming by 2 degrees Celsius, as specified in the Paris Climate Agreement.

It is important to describe the considerable differences between the strategy of a company which is an issuer of green bonds and that of a company focused on getting high points for ESG components. When issuing green bonds, an investor who is focused on the characteristics of the issue itself (in accordance with the Green Bond Principles, the issuing company need not be entirely environmentally compliant in order to issue green bonds), while an investor who is focused on investing into companies with high ESG indicators will pay attention to the issuer's characteristics in particular.

⁴ URL: <https://www.icmagroup.org/green-social-and-sustainability-bonds/green-bond-principles-gbp/>

⁵ URL: <https://www.climatebonds.net/standard/taxonomy>

The Main Trends and Prospects of Development of the Green Bond Market

The first green bonds were issued in 2007 by the European Investment Bank. Since that time, the green bond market has been developing rapidly, both from the point of view of the total scope of issued obligations and from the point of view of issuers' structure. For example, Poland was the first country to issue green bonds at the sovereign level in 2016. In 2017, the American mortgage association Fannie Mae made one of the largest green bond issues (worth 24.9 billion US dollars) in the form of securitization bonds. In June 2017, an issuer from Malaysia made the first issue of green Islamic bonds (known as 'green Sukuk'). Thereafter, the structure of green bond issuers expanded, including supranational authorities, corporate institutions, pension funds, commercial banks, non-financial entities, and municipal authorities.

In recent years, the green bond market has grown rapidly. In 2019, for example, the total amount of green bond issues increased by 53% in comparison to the previous year and exceeded 200 billion US dollars⁶.

Out of the possible reasons for the rapid development of green bonds, we can distinguish⁷ a better understanding of the relation between the climate change and its potential influence on the financial system. This may be seen to be characterised in terms of investor support (as well as political support) in relation to the signing of the Paris Climate Agreement by approximately 200 countries in 2015.

Corporate institutions and financial institutions accounted for a plurality of issues in 2019. Investors from several regions declared an excess of demand for green bonds issued, in particular by corporate issuers⁸. In terms of regions, the largest share of issues in 2019 fell to European countries (approximately 45%), followed by the Asian-Oceanian countries, and North America. In 2019 the largest part of proceeds from green bond issues was invested in the projects related to the power industry, construction, and transport. It is most likely that for the foreseeable future the existing structure of issues by industries and regions will not undergo significant changes.

According to a forecast from Moodys⁹, the amount of green bond issues in 2020 may achieve 300 billion US dollars. Attaining the sustainable development goals declared by UNO requires a significant economics decarbonization, and as such the convenience potential for financing projects by means of green bonds is significant. As a result,

there is a substantial potential for growth of the green bond market, due particularly to emerging-economy countries where environmental issues are still acute. Development of the green bond market in the medium term may be contingent upon the following factors: support from governments (privileges, subsidies, other easing of some requirements), reduction in the cost of environmentally-friendly technology which will make its application more economically viable, the question of price dynamics for key energy resources, and the question of prices for carbon dioxide emission quotas¹⁰. Analyzing the structure of projects according to the areas in which investments are made through green bonds, one can see that in such sectors as industrial production, an apparently inadequate level of funding is observed. In the coming years, a growth in green bond issues by financial institutions¹¹ is possible because the amount of credits issued for the funding of projects in the area of sustainable development will grow rapidly.

In the years ahead, a decrease of the rate of growth of the green bond market may be related to both a transition of the market into the maturity stage and a 'cannibalism' process, accounting for the growing segment of social bonds and bonds aimed at funding sustainable development projects – i.e. sustainability bonds (the total volume of the market of green bonds, social bonds and sustainability bonds at the end of 2019 is evaluated by CBI as 400 billion US dollars. However, against the background of the combined debt market, the share of green, social and sustainability bonds is still insignificant (approximately 5%). Other factors which may adversely affect the demand of supply for green bonds are information asymmetry, insufficient qualifications of some market players (for example, verifiers) and an excessive tightening of the regulations and procedures necessary to be implemented in order to issue bonds. Among the factors which have a detrimental effect on the market at its present stage of development are the absence of a unified regulation and unified standards of the market, greenwashing, and a low quality of furnished public information (it is necessary to provide for its disclosure on a regular basis).

Thus, in spite of certain challenges for development (from a regulatory point of view, e.g. the absence of universally-acknowledged standards, the greenwashing problem, and the problem of professional qualification of some players) the green bond market is developing rather rapidly. Green bond issuers are substantially diversified by sectors, regions of location, and types of borrowers.

⁶ Calculations were made on the basis of the green bond database of Thomson Reuters.

⁷ Banga J. The green bond market: a potential source of climate finance for developing countries, 2019.

⁸ CBI (2019). Green Bond. European Investor Survey. URL: <https://www.climatebonds.net/resources/reports/green-bond-european-investor-survey-2019>

⁹ URL: https://www.moodys.com/research/Moodys-Green-social-and-sustainability-bond-issuance-to-jump-24--PBC_1212910

¹⁰ In a series of regions/countries/cities various systems are in force which aim at stemming emissions of CO₂ into the atmosphere (such as emissions trading system, carbon dioxide tax).

¹¹ S&P (2019) Green Finance: Modest 2018 Growth Masks Strong Fundamentals for 2019.

Literature Review

An important part of the literature review is the analysis of “fundamental” articles studying the factors which have an impact on the yield of bond issues in different countries in various years. To analyse the influence channels of green bond issues on issuers, we considered research on the response of shares price of issuing companies to information about the bond issue. In the majority of considered articles [1; 3–8] discounts on green bond yields are shown. These yield discounts may be contingent upon a lower risk of such securities because investors who are oriented toward investments meeting the sustainable development criteria are the ones interested in it. Besides, such investors may be targeted by means of long-term retention of securities in the portfolio. This may reduce the trade volumes of these issues in the secondary market and, as a consequence, result in a greater price stability. However, a series of authors have investigated the comparability of yield spreads of green bonds to traditional bonds adjusted for volatility [5]. Another argument for the existence of a negative spread to green bond yield is excess of demand over supply in this market segment, caused by the intrinsic characteristics of green bonds, or their insufficiency in the market at present.

The distinctive features of green bond issuers are subject to significant analysis in the academic literature. In the article [9] factors which influence the amount of borrowing through green bonds is analysed using a sample from 2010–2017. It is shown that the amount of one-time green bond issues is largely defined by standard factors: e.g. the coupon rate, credit rating, pledged collateral, state of the industry sector where the issuer operates, and the financial status of the company itself. The biggest rate of growth of green bond issues was characteristic of markets in emerging countries, especially the issues made in national currency, for example, in yuans. The authors emphasise the heteroscedasticity of the developed and emerging market of green bonds, which is indicative of the fact that in order to regulate such markets various methodologies and policies should be applied. Another significant characteristic is the goodwill of the issuing company and the existence of verification of compliance with the principles of green financing. The analysis shows that yield discounts and a higher marketability are characteristic of green bonds from institutional issuers, in comparison to commensurable issues of traditional bonds. However, issues from private issuers show positive premiums and lower liquidity levels [10]. The authors analysed issues in greater detail from private issuers and found out that there were significant premiums in the issues which did not have an official confirmation of compliance with Green Bond Principles and other verifications.

The influence of the liquidity level is considered in many papers [1; 11]. The authors use adjustments to calculate the liquidity of the analysed issues. They indicate that an active involvement of investment funds and other institutional investors at the stage of their issue (the primary

market), and possession of these assets up to the point of maturity results in a decrease of trading and, as a consequence, a decrease in liquidity [4]. It is important to take into consideration the liquidity factor, because a yield of the issues which are not actively traded in the market may differ from the market level for such securities, and this may potentially result in a distortion of the obtained results.

The Fundamental Factors which influence the Yield Spread of the Issued Bonds

In order to enhance understanding of the topic and construct a more accurate model, it is necessary to study the factors which in the majority of cases influence the rates of return of corporate bonds. On the basis of the considered articles [12–22] one can make a conclusion that macroeconomic indicators, and the individual characteristics of issues and issuing companies have a significant impact on the yield factor, while the sectoral affiliation and the location country's characteristics are not always of significance.

Research Model

Hypotheses and Variable Models

On the basis of the literature analysis, we propose the following hypotheses:

H1: Investors pay premiums on green bonds.

H2: There is no substantial difference between the liquidity of green bonds and commensurable traditional issues.

H3: Yield premiums of green bonds of issuers from developed and emerging countries differ. In the issues made by issuers from developed countries, the yield premium on green bonds is more pronounced.

In order to test these hypotheses, we made a sample comprising corresponding issues made as of March 2020 from the Thomson Reuters database. We selected the commensurable bonds for comparison by means of sorting out the issues in the Cbonds platform. This was done in order to provide for intercomparison with the green bonds sample according to the following criteria: year of issue, issuer's sectoral affiliation, country of issue, coupon rate, credit rating level, and Macaulay duration or modified duration. In total, the initial sample comprised 3,477 observations (issues) within the period of 2007 to 2020, of which green bonds account for approximately 600 of them, the rest are the commensurable “classical” issues. As long as the information on the issuer's credit rating, and the difference between the bid and ask prices was not available for all selected issues, and these regressors, according to our opinion and literature analysis, may have a significant impact on the dependent variable OAS, the initial sample was reduced to 2,450 observations for which we have all necessary data.

For our evaluation, we used models 1 and 2 represented by the formulas below:

$$\begin{aligned} OAS_i = & \beta_0 + \beta_1 \cdot CPN_i + \beta_2 \cdot ISS_DATE_i + \beta_3 \cdot AMM_ISS_i + \beta_4 \cdot ISS_PR_i + \\ & + \beta_5 \cdot TEN_i + \beta_6 \cdot MIN_DEN_i + \beta_7 \cdot MOD_DUR_i + \beta_8 \cdot MAC_DUR_i + \\ & + \beta_9 \cdot AMM_OUT_i + \beta_{10} \cdot BID_ASK_i + \beta_{11} \cdot RATING_i + \beta_{12} \cdot GB_i + \\ & + \beta_{13} \cdot MKT_ISS_i + \beta_{14} \cdot CPN_FR_i + \beta_{15} \cdot GDP_i + \beta_{16} \cdot CPI_i + \\ & + \beta_{17} \cdot RATE_i + \varepsilon_i \end{aligned} \quad (1)$$

$$\begin{aligned} BID_ASK_i = & \beta_0 + \beta_1 \cdot OAS_i + \beta_2 \cdot CPN_i + \beta_3 \cdot ISS_DATE_i + \\ & + \beta_4 \cdot MOD_DUR_i + \beta_5 \cdot MAC_DUR_i + \beta_6 \cdot AMM_OUT_i + \beta_7 \cdot RATING_i + \\ & + \beta_8 \cdot GB_i + \beta_9 \cdot MKT_ISS_i + \beta_{10} \cdot CPN_FR_i + \varepsilon_i \end{aligned} \quad (2)$$

The variables used in the econometric analysis are defined as follows.

The first dependable variable, *OAS (Option - Adjusted Spread)* was calculated as the spread of yield of the analysed issue, and the yield of commensurable risk-free bonds (traditionally OAS is calculated using the same values of riskless rates as are used for the calculation of Z-spread, i.e. non-coupon ones). The values of the OAS variable for the analysed issues were taken by the authors from the Thomson Reuters database.

This spread is adjusted to take into consideration the possible inherent put or call options by taking into consideration the probable expenses for these issues ($OAS = Z\text{-spread} - \text{Option cost}$). When discounting cash flows from a bond issue for the riskless rate plus OAS, the value of the discounted cash flows from a bond is considered equivalent to its current cost. OAS is measured in percentage points. In the econometric analysis given below, in order to test the first hypothesis (regarding the existence of the negative return on green bonds in comparison with the commensurable traditional ones) OAS will serve as the dependent variable.

The second dependent variable *BID_ASK (Liquidity Estimation)* serves as a proxy to measure the degree of liquidity of the issue (it is calculated as a bid-ask spread (the difference between the ask and bid price) for this issue as of March 2020. The less the difference between the bid and ask price, the more active the trading for this issue is, and it is indicative of a higher liquidity. We suggest that a higher liquidity of an issue is indicative of a greater investors' demand, and hence in case of a greater demand the yield spread decreases.

CPN (Coupon) is the coupon rate of a bond issue in per year terms and is measured in percentage terms. All other things being equal, the coupon rate may have a positive impact on OAS value.

ISS_DATE (Issue Date) is the year of a bond issue. It is anticipated that the variable of the issue year has no direct impact on the issue's rate of return, but the macroeconomic situation at a certain time and dynamics of development and popularisation of the green bond trend with the passing of the years may leave their traces. Further, we

can clusterise issues by years of issue for a more detailed study of inherent trends.

AMM_ISS (Amount Issued) is the issue volume within the designated issue expressed in US dollars. Usually, large companies make greater bond issues. As long as 'size' is one of the business solvency factors (as a rule, large companies are at the maturity stage of their life cycle, have a more sound market position, more steady cash flows and, in general, a more conservative financial policy) investors often perceive small companies as more risky. This is due to smaller companies' perceived greater volatility of revenue/less operating efficiency, a lower position in the market or a shorter history, and the fact that investors often require higher rates of return for the bond issues of such companies in order to offset the risk. In general, owing to their size and the opportunity to borrow larger sums in the public market, due to presence of demand those companies of a greater size which are well-established and well-known account for larger issues. So, we make an assumption that the amount of issue influences the OAS size negatively.

MKT_ISS (Market of Issue) is a binary variable which designates the market at which the bonds have been issued (1 – the bonds have been issued in the international market, 0 – the bonds have been issued in the internal "domestic" market). In view of the different degrees of development of financial markets of various countries, different markets endowments, different levels of financing education on green topics, and the fact that demand for bond issues and their liquidity may vary greatly among countries. As a general matter, the international bond market, e.g. the eurobond market, is better developed, characterised by greater investors' demand, greater marketability, and often, low rates. We presume that for the bonds issued in the international market, the required yield is lower.

CPN_CLASS (Coupon Class) is a binary variable which designates the coupon type (1 – a fixed rate, 0 – a floating rate). Influence of this variable on OAS will to a great extent depend on the current macroeconomic environment at the date of issue, investors' expectations, and time interest rate structure in the economics at the date of issue. However, in the general case, we make the assumption

that with the floating rate of the coupon the investor faces a greater uncertainty, and as a consequence, a greater risk, and against this background the rate of return required by the market will be greater.

CPN_FR (Coupon Frequency) is a binary variable which designates the coupon payment frequency (1 – annually, 0 – otherwise) (mainly by half years). In our opinion, there is no question of a straightforward influence of this regressor on OAS, however, in order to exclude the possibility of its significant influence, we think it expedient to add this variable in the initial model specification.

ISS_PRICE (Issue Price) is the nominal price when bonds are issued, and it is measured in percent. All other things being equal, a lower price than the nominal one for an issue means a higher revenue from investors, consequently, we anticipate an adverse influence of this variable on OAS.

TEN (Tenor) is the number of years till the issue maturity and is measured in years. The direction of influence of this variable on the rate of return required by the investors depends on the prevailing interest rate structure at the date of issue. However, in general, we assume a positive dependence of percentage rates on the investment horizon. Considering the problem from this point of view, we presume that the longer the maturity period, the greater the real effective yield of the issue is.

MIN_DEN (Minimum Denomination) is the minimal sum for which trading is accepted as regards a certain issue per one person or legal entity and is measured in US dollars. By analogy to the variable designating the issue volume, we anticipate that large companies make greater issues and account for a larger segment of the minimal trading amount. The negative dependence between the mentioned factor and OAS follows from the logic stated above.

MAC_DUR (Mac. Duration)- Macaulay duration, a predicted value. Basically, we presume that the higher the duration, the bigger the interest risk and greater OAS spread.

AMM_OUT (Amount Outstanding) – the volume of a certain issue in circulation at present, in US dollars.

GB (Green_Bond) is a binary variable (1 – in case of green bonds and 0 – otherwise).

RATING (Credit rating) is the numerical value of ratings of the top three of rating agencies for a certain issue. In order to calculate this indicator, the ratings were transferred from the literal expression into the integral equivalent (see appendix 1) and for each issue a mean value was taken between the Moody's, S&P, and Fitch ratings. We assume that the higher the rating, the greater the company credit quality, and therefore the lower the rate of return required by the market for this issue. A transformation of the literal rating scales into integral ones is also taken into account.

GDP (Gross Domestic Product Growth Rate) is the USA gross domestic product growth rate which corresponds to

the year of issue and is measured in terms of percent.

CPI (Consumer Price Index) is the USA consumer price index for the corresponding year and is also measured in percent.

RATE (Interest Rate) it is a proxy variable for the rate of borrowing of the USA banks.

Analysis of the Sample and Descriptive Statistics

In order to obtain a more accurate model, the data was purged of outlying data. The descriptive statistics after data preprocessing is represented in Table 1.

In order to obtain a more accurate model, the data sample was purged out outlying data. So, the values of the OAS variable less than zero and exceeding 1,000 were eliminated, the values of the coupon variable exceeding 11.71% were eliminated. The *iss_pr* variable was cleared from outlying data less than 95 and exceeding 103, the *min_den* variable values exceeding 1,000,000 as well as the values of observations with the modified duration exceeding 20, and the Macaulay duration values exceeding 19.8 and *bid_ask* values exceeding 2.5 were eliminated. All the above transformations did not go beyond the 80th percentile if outlying data was eliminated from above or 10th percentile when the outlying data was eliminated from below.

The first research hypothesis, as to green bonds having yield premiums, was tested using the logarithmic form of the dependent variable. Based on the findings of the multicollinearity verification using the Variance Inflation Factor (VIF), and constructing the pair correlation matrix for the analysed parameters, we eliminated from the model the regressors *amm_iss* and *mod_dur* which have a very high correlation with *amm_out* and *mac_dur*, respectively, but do not influence or have a little influence upon the dependent variable. The regression analysis established that at a 5% level the regressors *iss_pr*, *ten*, *mkt_iss*, *gdp* were insignificant, and so they were eliminated from the model. Thus, in the specified model all regressors are of significance at a 5% level. The Breusch-Pagan and White tests reject the hypothesis of homoscedasticity and are indicative of the presence of heteroscedastic errors in the model. In order to eliminate such errors from the model we used the standard error correction according to the White method in order to obtain robust standard errors.

As we can see from the obtained results in Table 2, the variable responsible for the bond being green or not is significant at a 1% level. Therefore, the suggested hypothesis of the presence of a negative yield premium on green bonds is not rejected. Based on the results of the obtained model we conclude that with green bonds, the spread reduces by 23.4%¹².

¹² Interpretation of results in percent on the basis of use of the dependent variable logarithm in the econometric model.

Table 1. Descriptive Statistics of the Sample

	N	min	p25	Mean	St.Dev	variance	cv	Median	p75	max
Oas	2,293	5.233	77.474	148.13	111.717	12,480.58	.754	126.506	185.559	927.023
bid ask	2,293	0	.129	.381	.37	.137	.972	.267	.5	2.5
Cpn	2,293	0	.875	2.294	1.612	2.599	.703	2.15	3.4	9.5
iss date	2,293	2008	2015	2016.162	1.886	3.556	.001	2016	2017	2020
amm iss	2,293	141,000	2.82e+08	7.25e+08	6.18e+08	3.82e+17	.853	5.72e+08	1.00e+09	3.00e+09
iss pr	2,293	96.05	99.589	99.752	.419	.176	.004	99.853	100	103
Ten	2,293	1	1	3.878	2.614	6.832	.674	5	6	9
min den	2,293	1	1,000	88,861.89	153000	2.33e+10	1.717	100,000	100,000	1,000,000
mod dur	2,293	.008	1.833	4.295	3.404	11.586	.793	3.833	5.864	19.573
mac dur	2,293	.008	1.882	4.466	3.56	12.672	.797	3.931	6.025	19.786
amm out	2,293	48,000	2.76e+08	7.14e+08	6.13e+08	3.76e+17	.859	5.63e+08	1.00e+09	3.00e+09
rating	2,293	1	4.33	5.679	2.83	8.009	.498	5.67	7.67	15.5
Gb	2,293	0	0	.29	.454	.206	1.563	0	1	1
mkt iss	2,293	0	0	.316	.465	.216	1.472	0	1	1
cpn fr	2,293	0	0	.514	.5	.25	.972	1	1	1
gdp	2,293	-2.5	1.6	2.232	.662	.439	.297	2.4	2.5	2.9
cpi	2,293	-.3	1.3	1.543	.735	.54	.476	1.6	2.1	3.8
rate	2,293	3.3	3.3	3.905	.653	.426	.167	3.5	4.1	5.3

Source: Author's own calculations.

Table 2. Final Specification of Model 1

Variables	After specification and elimination of heteroscedastic errors
Cpn	0.0791*** (0.00757)
iss_date	0.0110** (0.00538)
min_den	1.02e-07** (5.10e-08)
mac_dur	0.0344*** (0.00273)
amm_out	5.04e-11*** (0)
bid_ask	0.0761*** (0.0239)
Rating	0.166*** (0.00424)
Gb	-0.234*** (0.0206)
Cpi	0.0276** (0.0130)
Constant	-18.68 (11.71)
Observations	2,293
R square	0.7334
R square norm.	0.7323
F-statistics	697.65
P-value	0.0000

Robust standard errors in the brackets

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

Source: Author's own calculations.

The second hypothesis, on the differences in marketability between green bonds and commensurable traditional issues, was tested using the same sample, and the descriptive statistics and the process of eliminating outlying data coincide with the procedures described above. Due to the fact that the logarithmic form of the dependent variable describes our data better, the decision was taken to compare the models' functional forms. In order to define the best functional form we conducted the Box-Cox test, on the basis of which we may use the logarithmic specification.

Before defining the optimal set of regressors, we conduct the multicollinearity verification by means of the Variance Inflation Factor (VIF) evaluation. The *mod_dur* regressor was eliminated from the model immediately because of its high relation with the regressor responsible for the Macaulay duration. In specified model 2 all regressors are significant at a 5% level. The Breusch-Pagan and White tests reject the hypothesis of homoscedasticity and are indicative of the presence of heteroscedasticity-related errors in the model. In order to eliminate such errors from the existing model we used the standard error correction according to the White method in order to obtain robust standard errors. The results of this standard errors correction are offered in Table 3 below.

Table 3. Final Specification of Model 2

Variables	After specification and elimination of heteroscedasticity errors
Oas	0.00146*** (0.000291)
Cpn	0.0583*** (0.0221)
iss_date	0.0639*** (0.0136)
mac_dur	0.158*** (0.00662)
amm_out	-1.72e-10*** (0)
Rating	0.0798*** (0.0106)
Gb	-0.479*** (0.0443)
mkt_iss	0.136*** (0.0420)
cpn_fr	0.566*** (0.0713)
Constant	-131.9*** (27.41)
Observations	2,287
R square	0.4720
R square norm.	0.4699
F-statistics	226.13
P-value	0.0000

Robust standard errors in the brackets

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

Source: Author's own calculations.

As we can see from the obtained results, the variable responsible for the bond being green or not is significant at a 1% level. The hypothesis of absence of differences in the degree of marketability of green and traditional bonds is rejected. On the basis of the results of the obtained model, we observe that for green bonds the bid-ask spread decrease amounts to 47.9%, and this is traditionally considered to be a proof of a higher liquidity (a lesser value of difference between the bid and ask prices is usually contingent upon larger volumes of trading for these securities). A higher degree of liquidity of green bond issues may potentially be indicative of a more active trading of these issues.

Hypothesis 3 concerns the differences in the amount of the yield premium on green bond issues from developed and emerging countries. The hypothesis is based upon the assumption that for those issues which are identified by different issuers' categories from developed countries (due to the maturity of their financial markets), greater numbers of investors stand ready to invest in green bonds.

A lower country risk, operational risk, and currency risk means the negative yield premium on green bonds will be larger (higher by modulo).

In order to verify hypothesis 3, we expanded the initial sample and divided it into two sub-samples on the basis of the issuing company's geographical affiliation. These sub-samples comprise 4,444 issues from developed countries and 790 issues from emerging countries. The difference in the number of observations in the two sub-samples is mainly related to the prevailing number of green bonds made by issuers from developed countries, so as a result we included in this sample a greater number of commensurable issues. The variables used in the model align with those mentioned above, except for the bid-ask variable, and this is contingent on an insufficient amount of information in the Thomson Reuters database as regards the indicators used as a proxy for marketability of new bond issues. The descriptive statistics of the sample for developed countries is represented in Table 4, and for emerging countries - in Table 5.

Table 4. Descriptive Statistics of the Sub-Sample of Developed Countries

	N	min	p25	Mean	St.Dev	variance	p75	max
oas	4,444	0.584373	83.76882	177.6368	159.6136	25,476.49	203.2341	1366.196
iss date	4,444	2009	2016	2017.447	1.963576	3.855632	2019	2020
cpn	4,444	-0.5	0.655	2.146406	1.695252	2.873881	3.25	11.71
amm iss	4,444	61,466	2.17E+08	6.79E+08	6.28E+08	3.95E+17	1.00E+09	5.40E+09
iss pr	4,444	81.07	99.61	99.80585	0.8785466	0.7718441	100	111.5
ten	4,444	1	3	6.84766	6.364604	40.50818	8	50
min den	4,444	0.01	2,000	105,740.7	245,463.5	6.03E+10	100,000	2,000,000
mod dur	4,444	0.002777	2.563743	5.729794	4.492593	20.18339	7.313456	24.8344
mac dur	4,444	0.002778	2.662372	5.907454	4.57491	20.92981	7.532564	24.97629
amm out	4,444	0	2.13E+08	6.68E+08	6.14E+08	3.78E+17	1.00E+09	4.00E+09
rating	4,444	1	3	5.807381	3.231802	10.44455	8	18
gb	4,444	0	0	0.1572907	0.3641156	0.1325802	0	1
mkt iss	4,444	0	0	0.4889739	0.4999347	0.2499347	1	1
cpn fr	4,444	0	0	0.5609811	0.4963232	0.2499347	1	1
gdp	4,444	-2.5	2.3	2.27797	0.4865079	0.2366899	2.4	2.9
cpi	4,444	-0.3	1.6	1.666517	0.5658958	0.320238	1.8	3.1
rate	4,444	3.3	3.5	4.535891	0.8414223	0.7079915	5.3	5.3

Source: Author's own calculations.

Table 5. Descriptive Statistics of the Sub-Sample of Emerging Countries

	N	min	p25	Mean	St.Dev	variance	p75	Max
Oas	790	5.23	162.19	427.8635	525.2393	275,876.4	489.76	3,721.58
iss date	790	2007	2016	2017.452	2.093355	2.095909	2019	2020
Cpn	790	0	2.75	3.865266	1.447725	4.382134	4.88	13.75
amm iss	790	2,328,140	3.00E+08	5.27E+08	3.89E+08	1.52E+17	7.00E+08	2.35E+09
iss pr	790	96.18	99.5	99.70023	0.4770827	0.2276079	100	101.56
Ten	790	1	5	7.991139	7.242402	52.45239	10	60
min den	790	1	150,000	240,689.1	266463.9	7.10E+10	200,000	1,000,000
mod dur	790	0	1.83	4.814253	4.927933	24.28453	6.1	38.68
mac dur	790	0	1.9	5.032544	5.057347	25.57675	6.39	39.49
amm out	790	0	2.88E+08	5.05E+08	3.76E+08	1.42E+17	6.50E+08	2.35E+09
Rating	790	1	5	7.785443	3.914376	15.32234	10	19.5
Gb	790	0	0	0.2	0.4002534	0.1602028	0	1
mkt iss	790	0	1	0.7898734	0.4076564	0.1661838	1	1
cpn fr	790	0	0	0.1911392	0.3934476	0.154801	0	1
Gdp	790	1.6	2.3	2.392279	0.4109449	0.1688757	2.9	2.9
Cpi	790	0.1	1.6	1.732278	0.6453567	0.4164853	2.1	2.9
Rate	790	3.3	3.5	4.467975	0.7721219	0.5961722	5.3	8.1

Source: Author's own calculations.

Due to the fact that the logarithmic form of the dependent variable describes our data better, the decision was taken to compare the models' functional forms.

In order to define the best functional form we conducted the Box-Cox test by means of the Zarembka transformation, which showed that the logarithmic form of the dependent variable describes this model better. The *mod_dur* and *amm_iss* regressors were eliminated from the model immediately because of their high relation with the regressors responsible for the Macaulay duration and volume in circulation, consequently, the regressor which characterises the interest rate level of a bank borrowing in the USA market at the date of the issue was eliminated. The Breusch-Pagan and White tests reject the hypothesis of homoscedasticity and are indicative of presence of heteroscedasticity-consistent errors in the model. In order to eliminate the heteroscedasticity errors from the model we used the standard error correction by the White method to obtain robust standard errors. In the final versions of the model insignificant regressors were eliminated (in the model based on the sub-sample of developed markets regressors *iss_pr*, *ten*, *amm_out*, *cpn_fr*, *gdp*, *cpi* were eliminated). In the model with the sub-sample based on the issues from emerging countries insignificant regressors *cpi*, *iss_date*, *ten*, *amm_out*, *min_den*, *gdp* were eliminated. All the remaining regressors from both models are significant at a 5% level (Tables 6, 7).

Table 6. Final Specification of the Model for the Developed Countries Sample

Variables	After specification and elimination of heteroscedasticity errors	After specification and elimination of heteroscedasticity errors and elimination of insignificant regressors
<i>cpn</i>	0.0772555 (0.0137837)	0.0708643 (0.0070537)
<i>iss_date</i>	0.0281569 (0.0061318)	0.0265398 (0.0045656)
<i>iss_pr</i>	-0.0120566 0.0084319	
<i>ten</i>	-0.000727 (0.0011043)	
<i>min_den</i>	8.58E-08 (3.08E-08)	9.65E-08 (2.87E-08)
<i>mac_dur</i>	0.1356471 (0.0131641)	0.138703 (0.011727)

Variables	After specification and elimination of heteroscedasticity errors	After specification and elimination of heteroscedasticity errors and elimination of insignificant regressors
<i>amm_out</i>	-1.60E-11 (1.22E-11)	
<i>rating</i>	0.1672886 (0.0038787)	0.1686369 (0.0032413)
<i>gb</i>	-0.2679526 (0.0173487)	-0.2630357 (0.0171192)
<i>mkt_iss</i>	-0.0400964 (0.0119871)	-0.0380079 (0.0116662)
<i>cpn_fr</i>	0.0259183 (0.031989)	
<i>gdp</i>	-0.0197566 (0.0122792)	
<i>cpi</i>	0.013715 (0.0130348)	
Constant	-51.9652 (12.18104)	-49.93104 (9.195298)
Observations	4,444	4,444
R square	0.7399	0.7392

Source: Author's own calculations.

Table 7. Final Specification of the Model for the Emerging Countries Sample

Variables	After specification and elimination of heteroscedasticity errors
<i>cpn</i>	0.0449991 (0.0145877)
<i>iss_pr</i>	0.1299713 (0.0437996)
<i>mac_dur</i>	0.0853683 (0.0178056)
<i>rating</i>	0.2139432

Variables	After specification and elimination of heteroscedasticity errors
	(0.006999)
gb	-0.1838883
	(0.0574116)
mkt_iss	0.3829604
	(0.0581621)
cpn_fr	0.2030747
	(0.0490561)
Constant	-9.614366
	(4.376281)
Observations	788
R square	0.8213
F-statistics	343.4
P-value	0.0000

As we can see from the obtained results, the variable responsible for the bond being green or not is significant at a 1% level. The hypothesis of difference in the amount of the yield premium in developed and emerging markets is thereby confirmed. The assumption that in developed markets the negative yield premium on green bonds is larger (higher by modulo) is confirmed. Thus, the green bond issues from developed countries have the yield premium lesser by 26.3%, while from emerging countries it is 18%¹³.

Conclusion

In this paper, we analyse the problem of whether investors pay the yield premium on green bonds. For this purpose, we applied a regression analysis and econometric tests in order to establish the significance of the binary variable which designates whether the analysed bond issue is green or not. This methodology was applied to bond issues made in the period from 2008 to the beginning of 2020. In accordance with the obtained results, the existence of a small but statistically significant yield premium from green bonds amounting to 23.4% in comparison to commensurable green issues was established. This result is of particular importance because our research was conducted with the use of a sample comprising more recent periods (2018, 2019 and the beginning of 2020), while the majority of research on this topic considers earlier time periods. On the one hand, due to a rapid development of the green bond market and, on the other hand, to slowing down of the rate of its growth in the recent years (and

possible transition into the maturity stage) the results obtained on the basis of the earlier data may be of no relevance in terms of a description of the contemporary patterns of the market. However, according to our results, even with a slowing down of the market growth rate and the emergence of a great number of market players, there is still a negative premium of green bonds in comparison to other, commensurable bond types.

The second major result of this paper is the proof of a greater degree of marketability of green bonds in comparison with non-green ones. In accordance with our obtained results, the spread decrease for green bonds amounts to 47.9%, which means that they are traded more actively and have a higher marketability.

The third significant result of our research is our confirmation of the hypothesis that the amount of the yield premium for bonds issued by issuers from developed-economy countries and those of issuers from emerging-economy countries differ. The negative yield premium in the green bond market is more pronounced for issuers from developed countries.

The practical importance of the present paper consists in the fact that, in accordance with the obtained results, investors, potential issuing companies, and public authorities may achieve a better understanding of the current situation of the green bond market in global terms and on a disaggregated basis through issuers from developed and emerging countries, and in this context, they may refine their decisions in this sphere.

The main obstacle for this paper was the fact that in the sample the data regarding the main variables such as the rating level, bid, and ask prices were absent, and therefore we had to reduce the sample.

This research may be expanded by taking into consideration the data on social and sustainable bonds, by analysing consistent patterns from the point of view of industry sectors, and by monitoring the amount of the premium across various market development time periods.

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¹³ Interpretation of results in percent on the basis of use of the dependent variable logarithm in the econometric model.

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Appendix. Coding of the Credit Rating Variable

Table. Transformation of Literal Rating Scales of the Variable (RATING) into Integers

Numerical scale	Moody's	Fitch/S&P
1	Aaa	AAA
2	Aa1	AA+
3	Aa2	AA
4	Aa3	AA-
5	A1	A+
6	A2	A
7	A3	A-
8	Baa1	BBB+
9	Baa2	BBB
10	Baa3	BBB-
11	Ba1	BB+
12	Ba2	BB
13	Ba3	BB-
14	B1	B+
15	B2	B
16	B3	B-
17	Caa1	CCC+
18	Caa2	CCC
19	Caa3	CCC-
20	Ca	C
21	D	D

Source: Author's own calculations.

Assessment of the Impact of the Level of Disclosure of Mandatory Non-Financial Information in Public Annual Reports on the Investment Attractiveness of a Company¹

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Assessment of the Impact of the Level of Disclosure of Mandatory Non-Financial Information in Public Annual Reports on the Investment Attractiveness of a Company¹

Abstract

In this study, we assess the influence of information disclosed by issuers in annual reports in accordance with the requirements of the Central Bank of Russia on the investment attractiveness of a company.

The empirical base of the research consists of annual reports of 60 Russian issuers from various industries over 10 years. On the basis of applicable regulations of the Bank of Russia we compiled an author's dictionary of terms (word forms). Using the methods of taking into consideration grammatical forms we calculated occurrences of the dictionary terms in the texts of annual reports. This study represents the first time that a rating of issuers on the basis of the disclosure index of mandatory non-financial information (INDEX) in accordance with the Russian legislation was made. By means of a probit regression we proved the interrelation between the disclosure index of mandatory non-financial information (INDEX) and the issuer's investment attractiveness. Additionally, by means of a panel regression we established the interrelation between the issuer's investment attractiveness and the level of information disclosure which characterises the issuer, its securities and dividend policy, and its risk management policy.

Key words: non-financial reporting, text analysis, investment attractiveness, issuer, text analysis

JEL classification: C33, D22, G32

¹ This article is based on the results of budgetary-supported research according to the state task carried out by the Financial University in 2019 on the topic "Ensuring the economic growth rate by increasing the attractiveness of domestic issuers", by the Financial University, Moscow, Russia.

Introduction

The transparency of information provided by issuers in public annual reports, and the completeness of its disclosure, are significant issues of discussion within the circles of professional business. In many countries worldwide, disclosure of non-financial information by issuers is voluntary. As for Russia, in accordance with its legislation, securities issuers are obliged to provide access for shareholders to financial and non-financial information. The reliability of an issuer's financial statements is confirmed annually by audit companies in accordance with the 'Federal Law of 30.12.2008 No. 307-FZ on Auditing'. Meanwhile, non-financial information regarding company operations is not subject to audit, is controlled by a regulator, and is disclosed in the issuer's public annual report in accordance with the requirements established by the Bank of Russia. The Regulations on Information Disclosure by Public Securities' Issuers (approved by the Bank of Russia on 30.12.2014 under No. 454-P) [1] establish the order, manner, time limits, and also define the type of financial and non-financial information subject to mandatory disclosure in the issuer's public annual report. The issuer's public annual report, along with information related to economic issues, contains data concerning non-financial aspects of the issuer's operations (development plans, the industry sector characteristics, risks, dividend policy, management principles etc.). It should be noted that this topic is of relevance at present, as the 'Law on Public Non-Financial Statements' was developed within the 'Concept of Development of Public Non-Financial Statements' approved by order of the government of the Russian Federation of 05.05.2017 No. 876-r.

The purpose of our research is to assess the influence of the disclosure index of mandatory non-financial information (INDEX) on companies (in accordance with the Russian legislation) regarding the attractiveness of their investment. Multiple research studies dedicated to this issue have explained the disclosure of non-financial information from the point of view of social-political and economic theories (agency theory, new institutional theory etc.) and, from the empirical point of view, proved the influence of non-financial information disclosure on the capital structure [2], share price [3], corporate operations performance [4] etc. In our research, on the one hand, we continue along the path of previous studies by considering standard issues of influence of non-financial information disclosure on corporate investment attractiveness. However, on the other hand, our research is different: 1) this study represents virtually the first time when the issue of influence of disclosure of certain categories of non-financial information on the attractiveness of corporate investment in accordance with the Russian legislation is considered; 2) we offer a methodology of calculation of the disclosure index of mandatory non-financial information (INDEX) in accordance with the Russian legislation, and compile an author's dictionary of word forms which

allows for evaluation of the information disclosure level; and 3) we provide a rating of the best and worst issuers according to the disclosure index of mandatory non-financial information (INDEX).

Literature Review

In accordance with the requirements of Russian legislation and the established international practice of standardising non-financial information disclosure, the annual reports of public companies contain mandatory financial information, strategic information, information which characterises sales markets, company forecast development, information on management and supervision bodies, business risks, significant corporate actions, environmental pollution, human resource management policy, etc. V.E. Udaltsov and N.M. Tikhonova [5] assert that voluntary disclosure may increase the liquidity of shares, and reduces cost of capital, while the level of information disclosure quality notifies investors of the business development strategy.

At present, there are various empirical research studies which evaluate the influence of non-financial information on the issuer's financial attractiveness. In the paper [6] it was proposed that transparency and information disclosure influence corporate performance (as measured by means of Tobin's Q and return on equity). Z. Rezaee and L. Tuo [7] proved the relation between non-financial information disclosure and leadership indicators in a sector after analysing 2,525 companies in four sectors in the United States of America in 2010 (the chemical industry, machine-building, electronics, and consulting services) on the basis of a panel regression. D. Mathuva and J.M. Kiweu [8] register the relation between the disclosure of social and environmental information and financial indicators for 215 savings and credit cooperatives in Kenya. A. Pavlopoulosa et al. [9], in their research, consider the relation between the quality of disclosure of integrated reporting and the profitability of a company.

In line with the abovementioned research studies, we assume that non-financial information disclosure also influences corporate financial indicators, as expressed through the level of attractiveness of corporate investment. Consequently, the mandatory non-financial information disclosed by issuers in public (non-financial) statements in general, and by groups in accordance with the requirements of the Bank of Russia is significant and influences the issuer's investment attractiveness.

Research Methodology

In order to assess an issuers' non-financial indicators and enhance their investment attractiveness, since 2014 the Russian Union of Industrialists and Entrepreneurs has been developing some domestic sustainable development indexes, being 'Responsibility and Transparency', and the 'Sustainable Development Vector'². In 2019 the Russian

² URL: <http://pcnn.pf/simplepage/indeksy-i-reytingi-v-oblasti-uctoychivogo-razvitiya-i-korporativnoy-otvetstvennosti/>

Union of Industrialists and Entrepreneurs and MICEX together defined the MRRT index Responsibility and Transparency³. The existing financial ratings in Russia (for example, RBC-5004, Expert 4005) comprise such indicators as profit before tax, volume of sales, net profit, and capitalisation. In its turn, the disclosed non-financial information is not included in the rating calculation.

Foreign authors use specialised dictionaries or bags of words in order to assess the level of non-financial information disclosure. At present, dictionaries in English have been developed for text analysis aimed at the evaluation of non-financial information disclosure. For example, the Dictionary of Economic and Social Value Orientation of a Company by T. Moss et al. [10], and the Corporate Social Responsibility Dictionary by N. Pencle and I. Mălăescu [11].

In this research, we offer the author's disclosure index of mandatory non-financial information (INDEX) of an issuer complying with the requirements of the Bank of Russia and based upon a technique similar to the 'western' one, which was applied to compile the author's dictionary of terms. The offered author's dictionary of terms was constructed according to expertise on the basis of requirements established in those laws and statutory instruments which regulate the manner of disclosure of non-financial information by issuers in annual reports. These instruments include:

- Regulations of the Bank of Russia of 30.12.2014 No. 454-P on Information Disclosure by Issuers of Public Securities [1];
- Letter of the Bank of Russia of 17.02.2016 No. IN-06-52/8 on Disclosure in the Annual Report of a Public Joint-Stock Company of the Report on Compliance with the Principles and Recommendations of the Corporate Governance Code [12].

At the first stage, we selected the terms which characterise the issuer's operations, and are subject to mandatory disclosure in annual reports. For example, art. 70.3 of section VII of Regulations No. 454-P establish that the annual report of a joint-stock company should contain "...the information on the amount of each type of energy resource (atomic power, thermal power, electrical power, electromagnetic energy, oil, motor gasoline, diesel fuel, industrial fuel oil, rock (natural) gas, coal, shale coal, peat, etc.) used by the joint-stock company in the reporting year in natural units and in monetary terms".

At the second stage, on the basis of an analysis of the issuers' annual reports, we distinguished the most widespread and relevant word forms. The first group of terms A1 Company Operations Characteristics (Table 1) comprised

the terms related to the issuer's energy resources: "petrol, water, water supply, fuel and lubricants, diesel fuel, diesel oil, thermal power, heat energy, electrical power, electricity, and energy resources". The other groups of terms of the author's dictionary (A2, A3, A4, A5, A6, A6, A7, A8) were formed in the same way.

Table 1. The Author's dictionary of terms, compiled on the basis of legislative instruments of the Bank of Russia⁶

Company operations characteristic (A1)	Securities and dividend policy (A2)
Petrol, water, water supply, fuel and lubricants, diesel fuel, diesel oil, thermal power, heat energy, electrical power, electricity, energy resources; investment program, performance indicators, priority development fields, operating results; mission, future operations plans, forecast, development program, strategic targets, development strategy, growth strategy, revenue, year's results, company today, industry profile, mark review, position in the industry, company position in the industry, profitability, sales markets, events of the year, trends of the sector development, loss, financial indicators, financial performance, net profit, types of activity, lines of business, investment mediums, main business	Shareholders with an ownership share, redemption of shares, guarantee of rights, stock holders, protection of shareholders' rights, golden share, number of shares in circulation, number of shareholders, principal shareholder, number of minority shareholders, non-controlling shareholders, nominal value of ordinary shares, shareholder rights, preferred shares, shareholder meetings, shareholders' agreement, shareholder's structure, equity holding structure, capital structure, dividend amount, dividend distribution, payment date, declaration date, dividend yield, dividend history, dividend policy, company capitalisation, credit ratings, unpaid dividend, report on dividend payment, dividend amount, dividend amount per share, amount of declared dividend, amount of declared dividend in aggregate

³ URL: <https://www.moex.com/ru/index/MRRT>

⁴ URL: <https://www.rbc.ru/rbc500/>

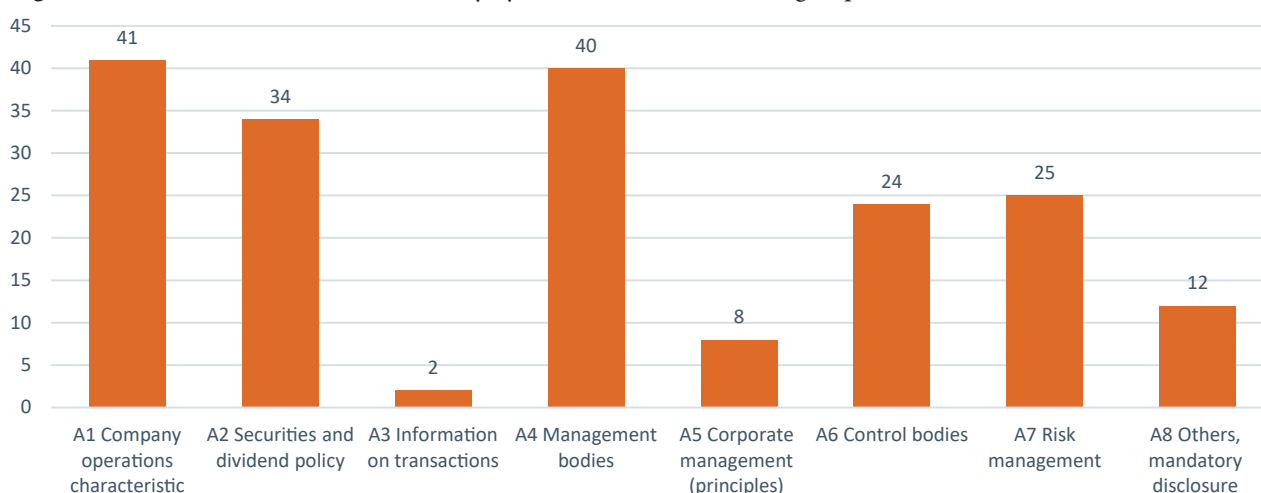
⁵ URL: <https://expert.ru/dossier/rating/expert-400/>

⁶ Regulations on Information Disclosure by Public Securities Issuers (approved by the Bank of Russia on 30.12.2014 No. 454-P), Letter of the Bank of Russia of 17.02.2016 No. IN-06-52/8 On Disclosure in the Annual Report of a Public Joint-Stock Company of the Report on Compliance with the Principles and Recommendations of the Corporate Governance Code.

Company operations characteristic (A1)	Securities and dividend policy (A2)	Company operations characteristic (A1)	Securities and dividend policy (A2)
Risk management (A7)	Management bodies (A4)	Corporate management (principles) (A5)	Control bodies, control (A6)
Principal risks, significant risks, risk factor, reputational risk, competition risk, loss of goodwill risk, risk of failure to implement the investment program, risks associated with the issuer's operations, judicial disputes, price change, operational risks, social risks, price risks, legal risk, legal risks, political situation, regional risks, sanctions, country risks, economic environment, currency risks, liquidity risks, risks of exchange rate growth, interest rate increase, financial risks, strategy risk	Types of remuneration, remuneration in money, ordinary shares award, annual bonus award, additional remuneration, reimbursement for expenses, principal remuneration, remuneration amount, remuneration to management, management bodies remuneration, remunerations to executive bodies' members, remuneration to board members, board members' revenues, salary, commission charge, premiums, information on cumulative remuneration, chief executive officer, year of birth, date of birth, chairman, president, controlling company, biographical details of the board members, biographical details, biography, biography details of the board members, ownership of shares by the board members, interest in the authorised capital, share of the board members in the authorised capital, background profile, carve-out of shares by members, obtaining of shares by members, acquisition of shares by members, sale of shares by members, information on transactions made by members of the board of directors, president, board members, change of directorship, composition of the board of directors	Corporate governance code, company secretary, board secretary, corporate governance principles, compliance with principles, key principles and recommendations of the code, report on compliance with principles, report on compliance with principles and recommendations of the code	Internal audit, internal audit directorate, audit committee, audit committee report, revision commission, internal control, corporate insurance, corporate-wide system of risk management, CSR, issuer's risk management policy, risk portfolio, risk management practice, risk management process, development of the risk management system, risk appetite, risk management, ICS, internal control system, risk management system, risk management and internal control system, RMS, RMaICS, risk management
		Information on transactions (A3)	Others, mandatory disclosure (A8)
		Major deals, interested-party transactions	Information policy, information disclosure, annual report has been approved, approved by resolution of, approval of the annual report, reorganisation, major corporate actions, major transaction

Source: Author's own research.

The author's disclosure comprises 186 terms subdivided into eight groups (Figure 1). It is clear from Figure 1 that the majority of terms of the author's dictionary, i.e. 41 terms, belong to the "first group" (A1) and they characterise the issuer's operations, the amount of the used type of energy resource in natural units and in monetary terms, information on the report of the board of directors, development prospects, position in the industry sector, and priority lines of business. The "second group" (A2) comprises 34 terms which characterise the issuer's securities, its dividend policy, and the issuer's interaction with shareholders. The "fourth group" (A4) consists of 40 terms. The information is related to bibliographic data and remuneration of company management. The smallest number of terms comprises the "third group" (A3) and includes the following word forms: major deals, interested-party transactions, etc.

Figure 1. Structure of the author's dictionary by the number of terms in a group

Source: Author's own research.

At the third stage, we calculated the number of dictionary terms in the companies' annual reports from the point of view of individual groups. It is impossible to implement this procedure applying ordinary text search method, because in the Russian language, virtually every term has several variations. For example, the dictionary term "dividend policy" may be used in texts in the forms "dividend policy" or "dividend policies". We needed a method which takes all possible word forms into consideration.

'Stemming' is one such method. The essence of stemming consists in abridgement of each word up to its unchangeable stem. For example, the words in the terms "dividend policy" will be abridged up to "dividend- polic-". Further, we can perform the same actions with the text in which we are going to search for terms, then we will look exactly for such a line of text, or use for our search the pattern "dividend* polic*" where "*" sign stands for any characters. At the same time, stemming yields good results only with long words. For example, if we take a word such as "rights", after stemming it turns into "right-".

Another widely spread method of taking into consideration grammatical forms is lemmatisation, which transforms all words both from search request and contained in the text in which the search is performed into their root form.

Lemmatisation greatly reduces ambiguity, but it cannot eliminate it completely due to homofoms. So, the word "rights" may be a form of both: the noun "right" (stakeholders' rights) and the verb "to right" (he rights the committed wrong). It depends on the context in which source form a word should be transformed in each individual situation, as a wrong transformation may be the reason for errors in the search. All this requires a serious manual control when reporting documents are lemmatised.

In order to avoid such problems, we decided to apply another method. The reporting documents were not changed as regards word forms. We performed only evident technical changes: the letters were written in lower case, non-alphabetic characters were eliminated, and

spaces were unified. This latter operation was necessary because annual reports are often presented not as a plain text but as a result of a professional designer's page make-up which, instead of spaces, may divide sentences with other symbols: page break, column break etc.

As long as word forms in a text were unchanged it was necessary to search for all possible word forms of dictionary entries. Therefore, a request was a regular expression which allowed to search for all such forms. For example, a regular expression for the entry "principal shareholder" searched for possible forms "principal shareholders", "principal shareholder's", and "principal shareholders'" (in Russian there are 10 word forms). All possible word forms were included automatically on the basis of the OpenCorpora dictionary, and therefore the possible homofoms were controlled manually. This was possible because the number of entries was small. In difficult cases the requests were also corrected manually: for example, in economic texts the term "risk management" may be written with a hyphen instead of a space. This method enabled us to automatically calculate the occurrence of dictionary terms in the annual reports' texts, avoiding distortion of the results.

The dictionary developed in this way became a part of the rulexicon library in the R environment. Below we provide an example of it in use. In order to calculate the terms occurrence, it is necessary to download the library.

```
1 #install.packages('devtools')
2 devtools::install_github('dmafanasyev/rulexicon')
```

Then we have to use the table with the dictionary. The next code line downloads the data into the variable keytable.

```
1 keytable=rulexicon::key_company_rus_report_standard
```

The data is of the following structure:

order
number of the group of terms (1 – A1, 2 – A2 etc.)

section
name of the group of terms

main_token

the main indicator: some key notion, information about which we should find in the text, for example, “development prospects”

token

a term: a certain word of the word combination which should be found in the text within the main indicator; thus, for the main indicator “development prospects” the terms “development strategy”, “growth strategy”, “development program”, “strategic objectives” etc. will be such terms

regex

a regular expression which contains all possible word forms of this term

The next code loads the stringr library for text processing and then it loads one of the annual reports into the text variable, in the example given it is a report of VTB Bank for 2018. The text lines are combined into one line and then the text is presented in lower case letters:

```
1 library(stringr)
2 text <- readLines('https://raw.githubusercontent.com/isdemin/repstandart/master/BankVTB2018.txt',
3 encoding = 'UTF-8') %>% paste(collapse = ' ') %>%
tolower
```

Further on the basis of regular expressions, the number of occurrences of each term in the text is calculated. The total number of terms is presented from the point of view of term groups:

```
1 occurencies <- str_count(text, keytable$regex)
2 by(occurencies, keytable$section, sum)
```

The result of this code execution is stated below:
keytable\$section: Corporate management (principles)
[1] 99

keytable\$section: Control bodies
[1] 294

keytable\$section: Management bodies
[1] 718

keytable\$section: Others, mandatory disclosure
[1] 44

keytable\$section: Information on transactions
[1] 2

keytable\$section: Risk management

[1] 59

keytable\$section: Company Operations Characteristic

[1] 252

keytable\$section: Securities and dividend policy

[1] 218

It can be observed that in this annual report all term groups are presented, however it is done unequally: the largest group is Management Bodies (718 occurrences), the smallest is Information on Transactions (2 occurrences). Thus, using the library does not imply lemmatisation and tokenisation of texts. A simple and short code performs the work. The 8 obtained index numbers calculated for each annual report were the values of variables A1–A8, upon which the subsequent data analysis is based.

Calculation of the value of the disclosure index of mandatory non-financial information (INDEX), developed on the basis of the author's dictionary may be described as follows:

$$\text{INDEX} = \sum A1 + A2 + A3 + A4 + A5 + A6 + A7 + A8,$$

where A1 is the group of terms Company Operations Characteristic;

A2 is the group of terms Securities and Dividend Policy;

A3 is the group of terms Information on Transactions;

A4 is the group of terms Management Bodies;

A5 is the group of terms Corporate Management (principles);

A6 is the group of terms Control Bodies;

A7 is the group of terms Risk Management;

A8 is the group of terms Others, Mandatory Disclosure.

The obtained index belongs within the final model of assessment of the influence of non-financial information on the attractiveness of corporate investment.

The research methodology comprised the panel regression and Logit-model. Tobin's Q ratio represented in the papers [6; 13; 14], was used as a dependent variable (investment attractiveness) and it is calculated by the following formula:

$$\text{Tobin's Q} = (\text{Market capitalisation} + \text{Obligations} + \text{Preferred shares} + \text{Ownership interest in a subsidiary}) / \text{Total assets. (1)}$$

We chose the following indicators of financial standing and market performance as control variables: return on assets (X1), return on equity (X2), weighed average capital cost (X3), economic value added (X4), assets (X5), weighed average share price by volume (X6), and share price / earnings per share ratio (X7).

Data Analysis

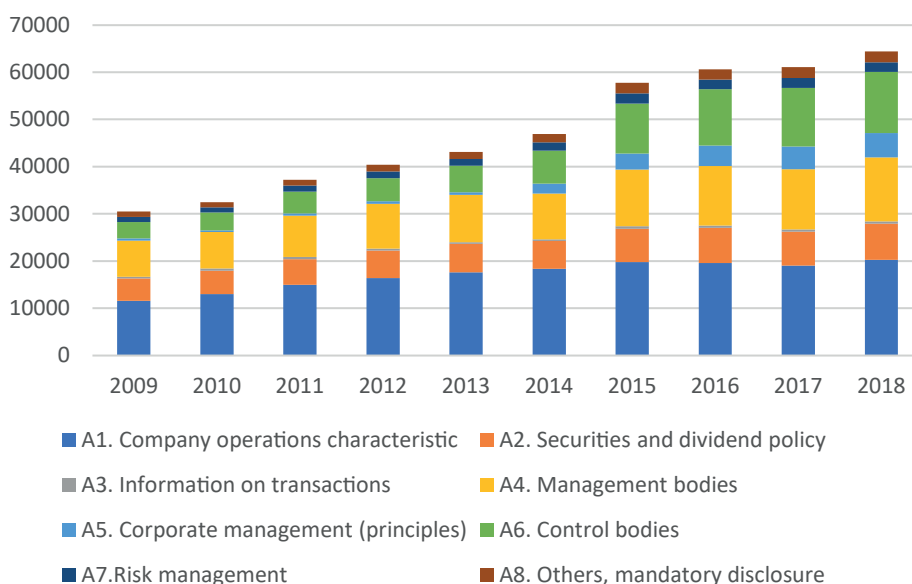
The empirical database of the research comprised 600 annual reports of the issuers for the period of 2009 to 2018, and 60 public Russian companies with the greatest capitalisation and listed at the Moscow Stock Exchange.

Let us consider the results of evaluation of the index (INDEX) of the studied groups in annual reports of the issuers in more detail (Figure 2).

On the basis of the results of our evaluation of the disclosure index of mandatory non-financial information (INDEX) we drew up ratings, ranking the best and worst annual reports of issuers for 2018. The leaders of the rat-

ing of the best issuers' reports on the basis of the amount of disclosure of mandatory information in annual reports for 2018 are represented in Table 2. Half of the issuers included in the rating of the best issuers' reports are energy providers. The top three in the rankings comprises companies with state participation. The Federal Grid Company of Unified Energy System (FGS UES) is the first in the rating, and its index (INDEX) for 2018 is 2,865. Inter RAO and MOESK (Moscow United Electric Grid Company) occupy the second and third place respectively, and the disclosure index (INDEX) of MOESK is smaller than the one of the company, occupying the second place, by four terms and amounts to 2,395.

Figure 2. Dynamics of mandatory information disclosure in annual reports as regards aggregated data for the period of 2009 to 2018 (number of terms)



Source: Author's own research.

Table 2. Ratings of the best public reports of issuers as regards the index (INDEX) for 2018 (number of terms)

No.	Company name (short)	Industry	A1	A2	A3	A4	A5	A6	A7	A8	INDEX	Tobin's Q
1	Federal Grid Company of Unified Energy System (FGS UES)	Power industry	999	232	53	472	348	570	33	158	2,865	0.46
2	Inter RAO	Power industry	1,131	158	12	294	303	383	41	77	2,399	0.73
3	MOESK (Moscow United Electric Grid Company)	Power industry	867	260	11	532	78	520	38	89	2,395	0.59
4	NORILSK NIKEL	Metallurgy industry	614	215	12	413	292	451	68	63	2,128	2.73

No.	Company name (short)	Industry	A1	A2	A3	A4	A5	A6	A7	A8	INDEX	Tobin's Q
5	AEROFLOT	Transport	815	173	16	417	195	371	45	73	2,105	1.18
6	LENENERGO	Power industry	660	193	9	438	54	480	43	81	1,958	0.59
7	VTB BANK	Banks	252	218	2	718	99	294	59	44	1,686	0.97
8	TATNETF n.a. V.D.SHASHIN	Oil and gas	695	247	6	255	77	232	68	47	1,627	1.65
9	KUBANEN- ERGO	Power industry	627	128	6	275	78	407	21	65	1,607	0.79
10	LUKOIL	Oil and gas	511	158	5	428	65	312	57	41	1,577	0.90

Source: Author's own research.

Table 3 presents the rating of the worst issuers, according to the disclosure index of mandatory information in annual reports for 2018. The companies from this rating have different industry specialisation and comprise machine building, trade and retail, transport, metallurgy industry, power industry, etc. However, it should be noted that all studied issuers' annual reports contain the minimum allowed number of terms, i.e. 186.

The company SOLLERS is the first in the rating, and their term frequency in the annual report amounts to 199 terms. Assessing the quality of terms disclosure, it is necessary to compare the number of terms in the author's dictionary and the obtained frequency results. Group A8 in the author's dictionary consists of 12 terms, and the term frequency in the "eighth group" in the annual reports made by such companies as SOLLERS, LENTA and Magnitogorsk Iron and Steel Works (MMK) is 3. The frequency for IRKUT CORPORATION and UTAIR is 2. Nevertheless, the obtained results do not imply that the companies fail to disclose other mandatory information and do not comply with the obligatory requirements of the Bank of Russia. The "eighth group" (group A8) of terms comprises synonyms and terms which characterise irregular business operations of the issuer, for example: reorganisation, major corporate actions, and major transactions.

The results of frequency in the "second group" (A2) of terms obtained by analysis of the annual report made by LENTA are of special interest. The "second group" (A2) of the author's dictionary comprises 34 terms. The frequency in this group for the company LENTA amounts to 4 terms, which is 30 less than the necessary number of occurrences. The obtained results may be contingent upon

a low quality of information disclosure in the corporate annual report and a failure to meet the required regulations of the Bank of Russia. In order to make well-founded conclusions it is necessary to investigate the annual report of LENTA for 2018 in great detail and identify the factors which influence the discovered deviations.

The annual report of LENTA for 2018 is drawn up on 146 pages. The information on the issuer's securities is presented on pages 122–123. The issuer discloses the following information: number of shares in circulation, types of shares, and information on the shares' issue. The testing results showed that the following terms were not mentioned in the report: amount of dividends, payment date, declaration date, dividend yield, dividend history, dividend policy. The obtained results are contingent upon the fact that the company issued shares without a nominal value. In implementing the Long-Term Incentive Program for business units' directors, dividends on ordinary shares in 2018 and 2017 were not declared. The information on the dividend policy is presented in the report as follows: "In accordance with British Virgin Islands Business Companies Act No. 16 of 2004 dividends may be declared and paid only if the Board of Directors confirms that immediately after dividend payment the Group will be able to fulfill the assumed obligations within the established period and in the ordinary course of business, and that the Group assets in case of their sale will not be less than the aggregate amount of obligations after deduction of deferred taxes stated in the accounting reports and its capital value". Thus, it can be affirmed that the information on the corporate dividend policy is disclosed in the annual report.

Table 3. Rating of the best issuers' reports as regards frequency of term disclosure for 2018 (number of terms)

No.	Company name (short)	Industry	A1	A2	A3	A4	A5	A6	A7	A8	INDEX	Tobin's Q
1	SOLLERS	Machine building	36	40	5	68	7	18	22	3	199	0.91
2	LENTA	Trade and retail	72	4	18	53	3	11	56	3	220	1.08
3	IRKUT CORPORATION	Machine building	67	57	3	56	11	35	39	2	270	1.07
4	UTAIR	Transport	52	55	3	109	17	49	15	2	302	1.76
5	IRKUTSEN-ERGO	Power industry	28	48	12	71	33	91	2	23	308	0.99
6	KUIBY-SHEVAZOT	Chemical industry	110	70	7	72	13	48	24	8	352	0.82
7	Magnitogorsk Iron and Steel Works (MMK)	Metallurgy industry	117	85	1	85	13	79	15	3	398	1.27
8	VSM-PO-AVISMA	Metallurgy industry	76	60	8	116	20	75	27	16	398	1.00
9	MECHEL	Metallurgy industry	80	79	4	110	19	94	27	6	419	1.86
10	SURGUT-NEFTEGAS	Oil and gas	133	77	3	73	17	82	19	17	421	0.33

Source: Author's own research.

The obtained results of our analysis, performed on public information disclosure in issuers' annual reports, brings us to the conclusion that the level of its disclosure is in accordance with the requirements of the Bank of Russia. In cases when the disclosure index (INDEX) is below the minimum value it is necessary to carry out additional analysis of the issuers' public reports. This is fundamentally to identify the factors which influence the absence from the issuers' reports of information subject to mandatory disclosure in accordance with the applicable requirements.

Main Research Results and Discussion

Using the Logit-model, we select from the aggregate and define the significant indicators which influence the issuer's financial attractiveness. The obtained results are represented in Table 4 and show the presence of a statistically significant interrelation.

Table 4. Results of assessment of the Logit-model of the issuer's investment attractiveness for the period from 2009 to 2018

Variable	Ratio	Standard error	Z-statistics	Significance
INDEX	-0.000862	0.000187	-4.603109	0.0000
X1	0.013588	0.003712	3.660357	0.0003
X3	0.087259	0.026963	3.236244	0.0012
X4	4.86E-12	1.51E-12	3.212370	0.0013
X6	0.000501	0.000125	4.007582	0.0001
const	-0.356094	0.286890	-1.241219	0.2145

Source: Author's own research.

On the basis of the constructed model we can conclude that the studied variables are an important factor when investment decisions are taken. The negative interrelation between the information disclosure index (INDEX) and Tobin's Q is contingent upon the fact that investors only pay attention to individual groups of terms which characterise risk management, securities, and the corporate dividend policy in the annual report, instead of the general disclosure of terms.

Out of the factors which we have considered, the information disclosure index (INDEX), return on assets, weighed average capital cost, economic value added, volume-weighted average price each have a significant impact on the issuer's attractiveness.

The obtained results are indicative of the fact that a company with a high Tobin's Q has a low information disclosure index. On the contrary, companies with a low Tobin's Q have a high information disclosure index. As was stated in the research [15; 16], on average the Tobin's Q ratio is stable in time. The issuers which show its high value, as a rule, are successful and have unique production factors or manufacture unique products. However, companies which show a low Tobin's Q operate in competitive (regulated) industry sectors, and incompletely achieve the potential of their intellectual capital.

Thus, the greatest frequency of the information disclosure index, as a rule, is characteristic of the following industries: power industry, oil and gas. The obtained results are indicative of the fact that energy companies with state participation (PJSC ROSSETI) are in the top three companies of the information disclosure index (INDEX). As such, the Tobin's Q ratio of the energy companies included in the rating of the best companies concerning the information disclosure index is in the range of 0.46 to 0.79. However, the energy provider IRKUTSENERGO (subsidiary of JSC EuroSibEnergO), included in the rating among the 'worst' reports, has a Tobin's Q ratio amounting to 0.99, which is higher than the "best" energy companies.

We presume that companies with state participation have a more responsible attitude to the quality of disclosed non-financial information in the annual reports, while the Tobin's Q ratio is contingent upon the regulated industry specifics of the issuer.

Further study is necessary for additional verification of the hypothesis which will define the groups of terms included in calculating the information disclosure index, and which have most influenced the obtained result. The results of making the panel regression are presented in Table 5.

Table 5. Results of making the panel regression with a random effect which defines influence of A1–A8 factors on the issuer's investment attractiveness

Coefficients	Estimate	Std Error	z-value	Pr(> z)
Const	8.3302e-01	9.4125e-02	8.8502	< 2.2e-16 ***
A1	-5.0451e-04	1.6556e-04	-3.0473	0.002309 **
A2	2.1633e-03	1.6662e-03	1.6983	0.104180
A7	3.2657e-03	1.5024e-03	2.1736	0.029732 *
X1	6.5595e-03	2.7892e-03	2.3518	0.018685 *
X3	3.4682e-02	6.5899e-03	5.2628	1.418e-07 ***
X4	3.5963e-13	1.9683e-13	1.8271	0.067680
X5	-2.1716e-14	1.1431e-14	-1.8997	0.057469
X6	4.6573e-05	1.7961e-05	2.5929	0.009516 **

Source: Author's own research.

In order to choose the correct model specification, we applied the Hausman test. The zero hypothesis of the Hausman test consists in the fact that RE-model is better than the FE-model, and its alternative is that FE-model is better. We chose a model with random effects. Let us now consider the obtained results. First of all, we discuss the analysis of the individual statistical significance of each of the eight groups of terms (A1, A2, A3, A4, A5, A6, A7, and A8), made on the basis of regulatory documents of the Bank of Russia, and included in the calculation the disclosure index of mandatory non-financial information (INDEX).

Testing showed that such variables as A3, A4, A5, A6, A8 turned out to be statistically insignificant. At the same time, a significant interrelation related to indicator 'A1 Company Operations Characteristic' (with a negative coefficient) is indicative of the fact that information disclosure in public annual reports influences the issuer's investment attractiveness. We also defined that pieces of important information for investors include data on securities and corporate dividend policy (A2 group), and issuer's operations risks (A7 group). Therefore, the relation between the studied indicators is positive.

Thus, the practical significance of the obtained results of

the research consists in the fact that in order to increase the issuer's investment attractiveness, when preparing non-financial reports, the issuers have to pay special attention to the group of terms which characterise securities, dividend policy, and corporate risks.

Conclusion

Non-financial information on the issuer's operations is disclosed in the issuer's annual report in accordance with the requirements established by the Bank of Russia. The data disclosed in the public annual reports is a public information source for concerned parties on the efficiency of the issuer's operations. As such, the frequency of word forms disclosed in the text of an annual report of an issuer was used in order to evaluate the completeness of information disclosure in accordance with the Russian legislation.

On the basis of the author's disclosure index of mandatory non-financial information (INDEX) we calculated ratings of the worst and best companies in terms of information disclosure for 2018. We established that every issuers' annual reports contain the minimum permissible number of terms.

As a result of our research, we confirmed the underlying assumption that there is a relation between the disclosure index of mandatory non-financial information (INDEX) and the issuer's investment attractiveness. The negative interrelation between these indicators is contingent upon the fact that investors only pay attention to individual groups of terms, e.g. those which characterise risk management, securities, and the corporate dividend policy, instead of the general disclosure of terms in the annual report. After appraising the obtained results (concerning the power industry) we showed a negative interrelation between the indicators. We assume that the implication of the obtained results is that energy companies with state participation pay a lot of attention to information disclosure in annual reports, while the Tobin's Q ratio being below 1 is contingent upon the regulated industry specifics.

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Impact of Intellectual Capital on Mergers and Acquisitions: Evidence from Developed and Emerging Capital Markets

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Impact of Intellectual Capital on Mergers and Acquisitions: Evidence from Developed and Emerging Capital Markets

Abstract

In this article, we analyse the influence of intellectual capital on M&A performance in developed and emerging capital markets with the use of the event studies and regression analysis methodologies. In contrast to previous research studies in this area, we assess the impact of the components of intellectual capital (human, structural, and relational capital) on firm value as a result of mergers and broaden the scarce level literature on this specific topic. We additionally present a comparative analysis of the influence of intellectual capital components on M&A performance vis-à-vis the performance of acquirers from developed and emerging capital markets.

Our research sample consists of 194 cross-border deals closed in the period 2010–2018. We compare developed markets based on firms from USA, Canada, Germany, Great Britain, France, Italy and Japan and emerging markets based on firms from China, India, Brazil and Malaysia.

Our findings contribute to the literature in several ways. Firstly, we document a positive and significant dependence between the level of intellectual capital of the target firm and the M&A performance level of the acquirer, irrespective of the market where the acquirer operates. We provide empirical support for the postulation that the higher the level of intellectual capital of the target firm, the higher M&A performance of the acquirer will be in both developed and emerging markets. Secondly, we empirically prove that each of the components of intellectual capital of the target firm increases M&A performance: the higher the level of human, structural or relational capital of the target firm, the higher the M&A performance level of the acquirer in both developed and emerging capital markets. Thirdly, we show that the level of impact of human capital on M&A performance is higher for emerging market acquirers, and the impact of structural capital is higher for developed market acquirers.

Key words: intellectual capital, mergers and acquisitions, M&A performance; developed markets; emerging markets

JEL classification: G34, O34, O57

Introduction

In the knowledge-based economy, mergers and acquisitions are likely to be one of the most popular growth strategies which allow firms to increase their production rates and performance, decrease costs, diversify their asset portfolio, or enter new markets.

Nowadays, intangible assets tend to play a greater role in company management. In the knowledge-based economy, intellectual capital is considered to be the key economic resource which forms the basis of operations of any company and influences its effective performance. The creation, development, and accumulation of skills, knowledge and expertise which form the intellectual capital of a firm is a primary corporate objective [1]. Intellectual capital plays a significant role in the increase of business performance [2] and may be one of the governing motives for mergers and acquisitions [3].

The majority of researchers agree that the intellectual capital of a target company should serve to increase the value of the acquirer as part of a mergers and acquisitions deal. However, the motives of companies operating in various capital markets differ, and in some papers the impact of intellectual capital or its components cannot be proven with statistical measurements. Some papers studying emerging capital markets have obtained contradictory results in terms of the kind of influence intellectual capital exerts on company value as a result of mergers and acquisitions. This confirms that further research in this field is necessary. As such, the problem of development of intellectual capital measurement methods which, undoubtedly, influence directly the obtained research results is still relevant.

None of the researchers in this area doubt that in the modern competitive environment, characterised by swift changes caused primarily by the development of technologies and innovations, that intangible assets may help a firm to retain or even enhance its competitive positions in the market.

In spite of a large number of papers which study various aspects of intellectual capital, research in the form of a comparative analysis of the influence of intellectual capital on M&A performance *vis-à-vis* the performance of acquirers from developed and emerging capital markets is very scarce. Unlike previous academic papers, we include in the scope of our study an analysis of the impact of each component of intellectual capital (human, structural and relational capital) on the performance of such transactions. We also perform a comparative analysis of their influence on the value of acquirers in developed and emerging capital markets. For this analysis, we chose a period of transactions from 2010 to 2018 in order to distinguish the impact of intellectual capital and its components on M&A performance for those companies which had to rearrange their operations due to modern technologies and innovations.

The remainder of the paper is structured as follows. In the first section we present a literature review including

definitions of intellectual capital and its components. Here we also formulate our research hypotheses. The second section describes the research methodology, and the third one provides the sample used to test the research hypotheses. In the fourth section we discuss the obtained results, while in the fifth section we articulate our key conclusions.

Definition of Intellectual Capital and its Components

There are two main approaches to defining the intellectual capital of a firm: static and dynamic [4]. In accordance with the static approach, intellectual capital is defined as a reserve of external and internal resources owned by the company at a certain period of time [5]. As per the dynamic approach, intellectual capital also comprises activities aimed at using company resources, obtaining new knowledge, and creating firm value. Such activities include training company employees, R&D, and IT management. These kinds of activities allow a company to increase and expand the existing reserves of intellectual capital, and to create new ones [6–8].

There is one additional approach to defining intellectual capital which distinguishes its two main characteristics. Firstly, intellectual capital is considered among the intangible assets of a firm which cannot exist independently from or be assessed separately from other assets. Secondly, intellectual capital is a result of the use of capital, organisational, intellectual, and human resources of a firm [9–11].

Most often in academic literature intellectual capital includes three key components: human, structural, and relational [12–14]. Human capital consists of those resources which include the implicit individual knowledge of employees, their skills, competences, experience, abilities, talent, and interpersonal relations [15]. Human capital helps a company to respond to changes in its external business environment and is the main source of its added value, innovations, and strategic vision [12]. Unlike human capital, structural capital belongs to a firm. It is defined as the knowledge which a firm possesses at the end of a working day [15]. On the one hand, structural capital comprises information systems, the technologies of a company, and its intellectual property (including patents, brands, trademarks, copyrights, and know-how) [16]. On the other hand, structural capital includes corporate culture and management methods which maintain the operations of a company [4]. The structural capital of a company inspires its human resources to create and use knowledge and to derive profit therefrom [15].

Relational capital includes resources related to the company's relations with its stakeholders [4]. It encompasses the company image, key customers' loyalty, and the trust of the principal suppliers and partners. Relational capital links human and structural capital to external counterparts [17]. Some authors distinguish the so-called consumer capital which characterises the relations of a company with its customers [12; 15; 16].

Companies always strive to replenish insufficient resources which are necessary for their successful operations. They often achieve this goal by acquiring the assets of another company through mergers and acquisitions. A significant part of the acquisition price, especially in knowledge-intensive industries, is the paid-for intellectual capital of the target company [18]. In order to most efficiently use the acquired strategic resources based on knowledge, skills, the expertise of employees, the intellectual property of the company, and its relations with customers it is necessary to be able to define and measure intellectual capital of both the acquirer and the target company.

Literature Review of Impact of Intellectual Capital on M&A Performance in Developed and Emerging Capital Markets

The main methods used to measure M&A performance from the perspective of intellectual capital are the questionnaire method, case studies, and the event studies method.

Researchers applying the questionnaire method consider intellectual capital to be one of the main efficiency determinants. They draw the conclusion that the acquisition and retention of intellectual capital of the target company is acknowledged by the management personnel of acquirers from developed capital markets to be one of the key determinants which improve M&A performance [3; 20].

In order to achieve high results from mergers and acquisitions, companies aim to choose the target firm with the most valuable assets. One of the factors advertising for the value of the assets of the target is its reputation [21] which is a part of relational capital. For example, T. Saxton and M. Dollinger [21], using a selection of data on cross-border mergers and acquisitions closed in 1993 (where acquirers were 77 companies from developed markets) showed that the target company's reputation had a positive effect on the performance of mergers and acquisitions initiated by companies from developed markets.

C.M. Fong, C.L. Lee [22] and M. Matarazzo et al. [23] analysed the influence of reputation of the target firm on acquisition performance in terms of how the customers' attitude to the acquirer would change after accomplishing the transaction. The authors drew similar conclusions: acquisitions of firms with good reputations by developed market companies improve relations with customers and enhance customers' trust in the acquirer, thus resulting in the rise of its operational performance.

The human capital of target companies also plays a significant role in the acquisition process. For example, I. Nikandrou and N. Papalexandris [24], as well as Y. Weber et al. [25] proved that the acquisition by firms in developed markets of target companies with large investments in staff education and skill enhancement should lead to an increase in the performance of the acquirer.

Employees and top managers of the target company are an integral part of the human capital of a firm and are considered to be its strategic resource. M.F. Ahammad et

al. [26] in their paper, studied the influence of retention of managers from the target company on the performance of cross-border mergers and acquisitions. Based on empirical data on transactions initiated by 65 British companies, and aimed at acquisitions in North America and Europe during the period of 2000 to 2004, they showed that the extent of retention of employees has a positive and significant impact on M&A performance. Similar results were obtained in the earlier research dedicated to mergers and acquisitions performed by developed market companies [27–29].

Besides the quality of human capital and its retention, researchers also highlight the importance of the complementarity of human capital for success of mergers and acquisitions. The researchers manage to prove that such complementarity between the target company and the acquirer provides a developed market acquirer with benefits due to diversification, and increases its value as a result of mergers and acquisitions [28; 30].

The structural capital of the target company also plays an important role in mergers and acquisitions. For example, C. Francoeur [31] studied a long-term effect from mergers and acquisitions based on a database of 126 Canadian firms which were engaged in M&As between 1990–2000, as well as the impact of structural capital on M&A performance. The research reveals that mergers and acquisitions are more efficient when target companies are characterised by a high level of know-how and R&D investments. A positive influence of R&D investments and a number of patents on M&A performance was also identified, for example, in the paper by J. Bena and K. Li [32].

Academic papers studying the impact of intellectual capital on M&A performance in emerging capital markets demonstrate controversial results. For example, S.A. Grigorieva and A. Yu. Grinchenko [33] as well as S. Weusthoff and R. Meckl [34] revealed a positive influence of intellectual capital on the performance of mergers and acquisitions. However, the research by S. Weusthoff and R. Meckl [34], which studied 365 cross-border mergers and acquisitions initiated by companies from the BRICS countries during the period of 2005 to 2013, found a positive but statistically insignificant impact of intellectual capital on performance of the deals. One potential explanation may be the fact that market players perceive the acquisition of intellectual capital as long-term investments of a firm, and this is invisible in the short-term intervals analysed by the researchers. In the paper by A.M. Arikan [35], who studied 158 mergers and acquisitions by emerging market companies during the period 1988–1991, identified that the concentration of intangible assets of the target company which describes its intellectual capital has a negative impact on the long-term cumulative abnormal returns of acquirers.

As far as intellectual capital components are concerned, a positive influence of relational, human and structural capital on M&A performance was identified for companies from emerging as well as developed markets. For example, C.M. Fong, C.L. Lee and Y. Du [36], studying the impact of reputation as one of the determinants of relational capital in the success of mergers and acquisitions in

Chinese companies for the period 2005 to 2010, conclude that the higher the reputation of the target company, the higher managers of the acquirer evaluate the performance of mergers and acquisitions. L. Chalencon et al. [37] came to the same conclusion in evaluating the relationship between reputation, a number of customers of the target firm, and the performance of mergers and acquisitions initiated by companies from emerging capital markets between 2010–2015.

Both emerging market and developed market firms, when selecting a target, pay attention to such strategic assets as technology, patents, databases, and other components of structural capital which affect M&A performance.

Acquisition of companies with huge R&D investments facilitates the accumulation of technology and innovation resources and the development of competitive advantages. The research of R. Srivastava and A. Prakash [41] proved a significant positive impact of R&D intensity on M&A performance on the basis of 187 mergers and acquisitions initiated by Indian pharmaceutical companies. A positive but statistically insignificant influence of R&D intensity on M&A performance was found by X. Wu et al. [40] using a selection of data on 180 cross-border mergers and acquisitions made by Chinese companies in 2002–2012, as well earlier by M. Hassan et al. [39].

The significance of intangible assets nowadays is likely to grow as they help a firm to retain its sustainable competitive advantages in the fast-changing competitive environment of developed and emerging capital markets. Investments in human capital, R&D, information technologies, and advertisements, play an important role in maintaining the competitive positions of a company and in the achievement of its strategic goals and objectives [42]. One of the key motives of mergers and acquisitions of emerging market firms is to find developed market companies with a high quality of intellectual capital. As long as intellectual capital provides a company with a substantial competitive advantage over other market players, the acquisition of intellectual capital by means of mergers and acquisitions stimulates the performance of such M&A transactions and raises the value of the acquirer [34; 43]. In developed markets, intellectual capital is also considered to be one of the major success factors of mergers and acquisitions. M&A performance could also be affected by such factors as the similarity and complementarity of resources, the combination of knowledge, technologies, as well as customers and partners of companies which all describe intellectual capital [44]. Another determinant of M&A performance is the amount of intangible assets owned by the target company, which could be integrated and used by the acquirer.

Thus, based on the analysis performed we hypothesise:

H1: *in developed markets, M&A performance increases when the level of intellectual capital of the target company rises;*

H2: *in emerging markets M&A performance increases when the level of intellectual capital of the target company rises.*

Human capital, which comprises the abilities, skills, experience, and knowledge of employees, is an important determinant of M&A performance because it represents a strategic resource of a firm. There are two types of knowledge: explicit and implicit. While explicit knowledge may be expressed in writing in the documents of a firm, or recorded in digital form, implicit knowledge is based upon the practices and personal experiences of employees. As such, it is inseparable from its holder and, as a rule, has no tangible form. Both types of knowledge form the basis for company value creation. Implicit knowledge may be transferred to the acquirer only in the process of education, common projects, and collective work. This is directly connected with retention of employees in the target company in the case of mergers and acquisitions [26].

The more intensively a company uses human capital, the more significant is its influence on the company value. In this context, we can assume that the human capital of employees of the target company exerts an impact on the performance of mergers and acquisitions [39]. Human capital also includes company top management. Many experts assume that replacement of the company management with more qualified employees increases deal performance. However, in recent years the majority of the larger companies have tended to retain top management, and to avoid losing either the social or human capital or knowledge of the management team. They also try to decrease uncertainty regarding a new company for customers and employees of the target firm, and thus to raise the transaction performance level [26]. Expertise and education of top management and other employees of the company, as well as investments in education aimed at creation of human capital enhance firm performance and ensure its sustainable development.

The above mentioned helps us to generate the following research hypotheses:

H3: *in developed markets M&A performance increases when the level of human capital of the target company rises;*

H4: *in emerging markets M&A performance increases when the level of human capital of the target company rises.*

Relational capital includes not only the company's relations with its stakeholders, but also its reputation, the satisfaction of its customers with the company operations and products, and the firm image. The company's clients are the main party interested in its operations, and are considered to be one of its main sources of income. If a company is market- and customer-oriented, customer loyalty increases, thus stimulating company value growth due to steady cash flows and a reduction of investment risk [2]. Customer satisfaction facilitates the creation of competitive advantages and increases the company's market share. Relations with partners and customers, and channels of communication are recognised as firm assets which are able to increase its value. Sustainable relations with the partners and clients of a company help to improve a business model, allow for learning lessons from the experience of other companies, and thus assists

in raising operations performance as a result of the successful management of assets. The reputation of a target company is also the key element of relational capital. The acquisition of a reputable company stimulates new customers and increases the loyalty of existing customers, thus providing access to new resources [21]. Networks of target companies become one of the determinants of mergers and acquisitions [34]. The existing external and internal relations which form the relational capital of a firm in both developed and emerging markets give a new company an opportunity to operate successfully, and promote its development and sustainable growth.

Thus, we formulate the fifth and sixth research hypotheses:

H5: *in developed markets M&A performance increases when the level of relational capital of the target company rises;*

H6: *in emerging markets M&A performance increases when the level of relational capital of the target company rises.*

Examples of structural capital are patents, trademarks, brands, and technologies. Brand acquisition tends to be one of the determinants of M&A performance [34]. Brand value is especially important for companies from emerging capital markets because it gives them an opportunity to become more successful. However, there are not enough well-known brands in emerging capital markets, and so multinational companies buy brands in developed markets in order to improve client perception of these firms. As far as companies from developed markets are concerned, one of the main reasons of brand acquisition is the presence of new opportunities associated with the fact that the acquirer has patents. Foreign companies with patents which are in line with the operations of the acquirer are the most attractive assets to be acquired, because they raise the technology level of a new company and ensure economies of scale. If the technology portfolios of the target company and the acquirer are similar, it may result in a successful acquisition because the intellectual property of the target company may facilitate the further development of technologies and an extension of the current R&D.

The acquisition of structural capital of the target company may lead to a more efficient manufacturing processes, an optimisation of business processes for the purpose of cost reduction and quality improvement, and an improvement of the operational indicators of the acquirer. Structural capital can have a positive effect on the financial indicators of a firm: its acquisition by means of mergers and acquisitions facilitates the income growth of the acquirer, and an increase of its return on assets and equity. Structural capital also plays an important role in company value creation [40].

The performed analysis helps us to formulate the following research hypotheses:

H7: *in developed markets, M&A performance increases when the level of structural capital of the target company rises;*

H8: *in emerging markets, M&A performance increases when the level of structural capital of the target company rises.*

Emerging market companies regard the acquisition of firms from developed markets as a new stage of their development. This allows such companies to enter new markets and attract customers of the target companies, but also to compensate for the gap in the level of intellectual capital. This gap represents a situation whereby it is insufficient for emerging market firms to participate in the global competition based on knowledge, new technologies and innovations. At the same time, for developed market companies characterised by a high level of intellectual capital development, the acquisition of companies from developed countries is just a way to reinforce their competitive position [34].

Consequently, we can suggest the last group of hypotheses:

H9: *intellectual capital has a higher influence on M&A performance for acquirers from emerging capital markets than for acquirers from developed capital markets;*

H9a: *human capital has a higher influence on M&A performance for acquirers from emerging capital markets than for acquirers from developed capital markets;*

H9b: *relational capital has a higher influence on M&A performance for acquirers from emerging capital markets than for acquirers from developed capital markets;*

H9c: *structural capital has a higher influence on M&A performance for acquirers from emerging capital markets than for acquirers from developed capital markets.*

Methodology

In order to define the nature of influence of intellectual capital on performance of mergers and acquisitions we perform an OLS regression analysis. To analyse the performance of mergers and acquisitions the event studies method is used, in which the cumulative abnormal return (CAR) is the dependent variable.

The most important component of the research based on calculation of the cumulative abnormal return is the selection of two-time intervals: the estimation period and the event window. Within the estimation period, “normal” returns are measured. For their evaluation, we use the market model based on the linear dependence between the market return and the return on the share:

$$R_{it} = \alpha_i + \beta_i * R_{mt}, \quad (1)$$

where R_{mt} and R_{it} – market return and return on a share of a certain company on day t.

Coefficients α and β are calculated in the estimation period. Consequently, we find “normal” returns \widehat{R}_{it} for each day t of the event window using the following formula:

$$\widehat{R}_{it} = \widehat{\alpha}_i + \widehat{\beta}_i * R_{mt}. \quad (2)$$

To accurately measure the normal returns on shares it is necessary to choose an optimal estimation period: it

should not be too long or too short. In the majority of papers dedicated to the analysis of the performance of mergers and acquisitions, researchers choose an estimation period of between 100 and 200 days. Therefore, in this paper we use the estimation period of 120 days up to the event window, which is used in the majority of the research studies we have reviewed.

Many researchers measure the performance of mergers and acquisitions, varying the length of the event window to perform a more comprehensive analysis, and to avoid the insignificance of cumulative abnormal returns due to a too-long window. In this research, we also use several event windows of (+15, -15), (+5, -5) and (+3, -3) based on our review of papers which use the event studies method to analyse the influence of intellectual capital on M&A performance.

After choosing the estimation period and the length of the event window, we can calculate the cumulative abnormal return for shares of each company. First, it is necessary to calculate the actual return of shares and the market return per each day within the event window using the following formula:

$$R_{i(m),t} = \ln \frac{P_{i(m),t}}{P_{i(m),t-1}}, \quad (3)$$

where $R_{i(m),t}$ – actual market return (m) and shares of company i on day t;

$P_{i(m),t}$ and $P_{i(m),t-1}$ – the closing price of shares of company i and the market index on day t and on the previous day (t-1) respectively.

The abnormal return (AR_{it}) is calculated as difference between the actual (R_{it}) and normal return (\widehat{R}_{it}) on the

company shares on each day t within the event window:

$$AR_{it} = R_{it} - \widehat{R}_{it}. \quad (4)$$

In order to get the cumulative abnormal return of the shares of each company, we finally need to obtain the sum of all the abnormal returns calculated for each day of the event window.

$$CAR_i = \sum_{-t}^t AR_{it}. \quad (5)$$

Intellectual Capital Measurement

In this paper we use four variables to describe the intellectual capital of the firm. One variable reflects the intellectual capital of the firm in general. Three other variables represent its components: human, relational, and structural capital. Our basic research assumption is a hypothesis that all the components of intellectual capital characterise its various aspects, however, when put together they do not equal intellectual capital. See the results of checks for multicollinearity in Appendix 1 and 2.

K.E. Sveiby [19] postulates that in order to assess intellectual capital in terms of mergers and acquisitions it is necessary to use quantitative methods, and in particular ones based on the company's return on assets and market capitalisation methods. In our research we use a market capitalisation method, and intellectual capital is calculated as a difference between the book and market values of the company:

$$IC = \text{Market value} - \text{Book value}. \quad (6)$$

To assess the components of intellectual capital we use proxy variables, which are based on publicly available data and which are presented in Table 1.

Table 1. Variables for the measurement of intellectual capital components

Intellectual capital component	Variable measurement method	Description	Previous research
Human capital	Company sales Number of employees	Reflects average productivity and performance of the company and its employees and, consequently, of human capital in general	Dzinkowski, 2000; Chen et al., 2005; Kim et al., 2016 [46–48]
Relational capital	Corporate growth rates in sales	This indicator implies that the advantages of relational capital result in a growth in corporate sales	Dzinkowski, 2000; Wang, Chang, 2005; Garanina, 2011; Kim et al., 2016 [46; 48–50]

Intellectual capital component	Variable measurement method	Description	Previous research
Structural capital	SG &A (Selling, General and Administrative Expenses)	Reflects corporate investments in technological processes, research and development, improvement of business processes and company products	Chen et al., 2005 Garanina, 2011; Sydler et al., 2014; Scafarto et al. 2016 [47; 50–52]

Data and Sample

The main source of information on mergers and acquisitions, indicators which characterise such transactions, and the financial status of the companies participating in them, is the Bloomberg database. We also used corporate annual reports to calculate the indicators related to human capital.

In the present article, we take into account mergers and acquisitions initiated by companies from developed and emerging capital markets in the period of 2010-2018. Target companies are firms from developed countries. Emerging countries in which acquirers operate are analysed using Chinese, Indian, Brazilian, and Malaysian firms, because they are leaders in terms of the quantity of cross-border deals as well as their volume over the last 10 years. Developed countries are chosen based on the same criterion: USA, Canada, Germany, Great Britain, France, Italy, and Japan. Data on the quantity and volume of cross-border deals is taken from the statistical information provided by the Institute for Mergers, Acquisitions and Alliances [53].

To fall into the sample, all the transactions need to meet the following criteria:

- all transactions in the sample should be closed by the date of research;
- only cross-border mergers and acquisitions are analysed;
- mergers and acquisitions in which the acquirer or the target company belong to the financial sector are excluded from the sample. Such companies have a different structure of assets and obligations. They may be controlled by the government, which may have an impact on the results;
- the target company and the acquirer should be public companies because of the chosen methods of measurement of performance of mergers and acquisitions (event studies) and intellectual capital (the market capitalisation method);
- the acquired share should exceed 50% because acquisition of the controlling interest stipulates active integration into the target company and opportunities to take advantage of the acquisition of intellectual capital;
- availability of the data necessary to calculate the indicators of the regression model, for example, information on the number of the company employees.

Thus, the final sample comprises 194 mergers and acquisitions, of which 115 are initiated by companies from developed markets and 79 by companies from emerging markets.

In order to assess the influence of intellectual capital on the performance of mergers and acquisitions, the following regression model is used:

$$CAR_i = \beta_1 + \beta_2 IC_i + \beta_3 HC_i + \beta_4 SC_i + \beta_5 RC_i + \beta_6 Share_i + \beta_7 Val_i + \beta_8 ASize_i + \beta_9 ROA_i + \beta_{10} Payment_i + \Sigma B \cdot D_{countries} + INN + \varepsilon_i \quad (7),$$

where **IC** is a proxy variable which takes into consideration manifestations of the intellectual capital of a firm, and is calculated as a natural logarithm of the difference between the book and market value of the company;

HC is a proxy variable which takes into consideration manifestations of human capital of a firm and is calculated as a natural logarithm of the ratio between the total sales and the number of employees;

SC is a proxy variable which allows to take into consideration manifestations of structural capital of a firm and is calculated as a natural logarithm of the ratio between the total expenditures of a company and the number of employees;

RC is a proxy variable which allows to take into consideration manifestations of the relational capital of a firm and is calculated as sales growth rates of a firm;

Share is the share of the company which is acquired;

Val is the transaction value which is calculated as a natural logarithm of the amount spent on mergers and acquisitions;

ASize is the size of the acquirer expressed as a natural logarithm of the total amount of its assets as of the date of the transaction announcement;

ROA is profitability of the acquirer's assets, which characterises its performance;

Payment is a dummy variable which measures the method used to pay for the transaction. It takes on a value of 1 if the transaction is paid in cash and 0 in all the other cases.

We also introduce control variables for the countries of the acquirers and industries:

US, G, F, IT, UK, J are dummy variables for acquirers from the USA, Germany, France, Italy, Great Britain, and Japan, respectively;

CH, IN, BR, M are dummy variables for acquirers from China, India, Brazil, and Malaysia, respectively;

INN is a dummy variable which takes on a value of 1 if the industry is innovative and 0 for all other industries. Breakdown of industries into innovative and non-innovative is made on the basis of the UNIDO classification.

In order to test hypothesis 9 and its sub-hypotheses (stating that the effect of intellectual capital on the performance of mergers and acquisitions is greater when the transaction is initiated by a company from an emerging market), the model is tested based on the overall sample. In this case a new variable is used which measures joint influence of intellectual capital or one of its components, and the dummy variable which characterises whether the acquirer belongs to an emerging or developed capital

market ($Dev = 1$ if the acquirer is from a developed market, $Dev = 0$ if the acquirer is from an emerging market). For this purpose we introduce new variables, which are obtained by multiplying intellectual capital or its components by the dummy variable ($IC_Dev = IC \cdot Dev$; $HC_Dev = HC \cdot Dev$; $RC_Dev = RC \cdot Dev$; $SC_Dev = SC \cdot Dev$).

Analysis of the Impact of Intellectual Capital on M&A Performance

Before testing the hypotheses, we calculated cumulative abnormal returns for all the companies to analyse the performance of cross-border mergers and acquisitions in developed capital markets. CAR was calculated for the whole sample, as well as for two sub-samples. The first sub-sample comprises transactions initiated by developed market firms and the second sub-sample includes transactions initiated by emerging market firms. The results of the calculations are presented in Table 2.

Table 2. Analysis of efficiency of mergers and acquisitions

Event window	CAR value in % (t-statistics)		
	The whole sample (194 observations)	Emerging markets (79 observations)	Developed markets (115 observations)
CAR (-15 +15)	-2.324 (0.82)	-4.145 (0.96)	1.08 (1.24)
CAR (-5 +5)	1.055 (1.51)	0.68 (1.32)	2.86 (1.79)*
CAR (-3 +3)	2.332 (1.77)*	1.14 (1.56)	3.039 (2.19)**

Significance levels: * 10%; ** 5%; *** 1%.

Source: authors' own calculations.

On average, mergers and acquisitions aimed at the acquisition of a developed market firm are efficient within the event window of $(-3, +3)$ where the cumulative abnormal return is significant and equals 2.332%. If we compare transactions by the acquirer's origin, we may say that transactions initiated by companies from developed countries create a greater value in two short windows than transactions where the acquirer operates in an emerging market. This may be explained by the fact that when companies from emerging markets enter developed markets through mergers and acquisitions they face more serious cultural and institutional constraints. In the window of $(-3, +3)$ the market response to mergers and acquisitions is positive and statistically significant: at the 10% significance level for the overall sample and at the 5%

significance level for developed markets. At the long event window of $(-15, +15)$ all cumulative returns are insignificant. This may be a result of a too-long event window, which takes into account other corporate events and may distort the obtained results.

We use the event window of $(-3, +3)$ to test the rest of the hypotheses. Besides, the seven days event window of $(-3, +3)$ was used by R. Meckl and S. Weusthoff [34] when they analysed the impact of intellectual capital on performance of cross-border mergers and acquisitions in which the acquirer from an emerging market enters a developed market. In addition, we used the Chow test to check whether the sample should be assessed as a whole or divided into two sub-samples. The results of the Chow test are given in Appendix 3.

Table 3. Results of testing the influence of the intellectual capital in developed and emerging capital markets (complete testing results are presented in Appendix 4)

For the event window of (-3, +3)		
Variables	Developed markets	Emerging markets
Constant	-0.04905	-0.03603
IC	0.06950*	0.07206*
HC	0.04978**	0.05388**
RC	0.00895*	0.00819
SC	0.00867	0.00782
ROA	0.22598	0.16804
Payment	0.07535**	0.04568
Val	0.14825	0.17926*
ASize	0.00434	0.00854
Share	0.03574	0.07135
US	0.00816	
G	-0.00528	
F	-0.00494	
IT	-0.00685	
UK	0.00546	
J	0.00088	
CH		0.02971
IN		0.00907
BR		0.00736
INN	0.01259	0.01138
R ²	0.4226	0.4182

Significance level: *10%; **5%; ***1%.

Source: authors' own calculations.

As we can see from Table 3, the intellectual capital of the target company has a positive effect on the cumulative abnormal return at the 10% significance level for acquirers both from developed and emerging markets. The higher the level of intellectual capital of the target, the higher the performance of a deal for the acquirer. Thus, hypotheses 1 and 2 about the positive influence of intellectual capital on performance of transactions cannot be rejected at the 10% significance level. Similar results about a significant and positive influence of intellectual capital on the perfor-

mance of mergers and acquisitions were also obtained in other papers which study mergers and acquisitions initiated by companies from developed markets [3; 14; 20] and emerging markets [33]. Intellectual capital is considered by many researchers to be one of the key determinants of M&A performance. However, our results differ from the results obtained by R. Meckl and S. Weusthoff [34] and A.M. Arikan [35] who showed that influence of intellectual capital for companies from emerging countries was in the first case positive but insignificant and in the second case – negative. The differences of our results and the results of the research by A.M. Arikan may be explained by the long-term event window he used [35].

Our results demonstrate that the impact of human capital on M&A performance is positive. The coefficient of influence of human capital is significant at the 5% level for companies from emerging as well as from developed capital markets. So, hypotheses 3 and 4 cannot be rejected. The obtained results correspond with the previous research studies in the field which managed to prove a significant positive relation between human capital and the performance of mergers and acquisitions initiated by companies from developed markets [24; 26] and emerging markets [38; 39]. The obtained results may be explained by the fact that employees who are highly qualified, well experienced, who have attended various training programs, lectures and workshops, who have knowledge on specificities of the firm operations, who are also self-motivated and who strive to work for the benefit of the company are a special strategic asset in favour of firm performance and, consequently, serve to improve its indicators, for example revenue growth.

In the current paper, we managed to empirically identify a positive relationship between the relational capital of the target company and the cumulative abnormal return at the 10% significance level for companies from developed countries. For companies from emerging markets we also found a positive relationship between relational capital of the target company and cumulative abnormal return. However, it was statistically insignificant. A positive impact of relational capital on M&A performance was found earlier in the research of C.-M. Fong, C.-L. Lee and Y. Du [36] and L. Chalencon [37] for emerging capital markets. T. Saxton and M. Dollinger [21] in their research also identified that the reputation of the target company has a positive impact on success of mergers and acquisitions in developed markets. The positive impact of relational capital on performance of mergers and acquisitions may be explained as follows: a good reputation of the target company means that customers as well as partners highly appreciate and trust in the target firm, which directly influences its performance. Therefore the acquisition of such a company makes the acquirer, when it enters a new market, use the existing reputation of the target company to strengthen its competitive position and to expand its presence. Besides this, a large and solid database of customers and suppliers owned by the target company comes into the possession of the acquirer after the M&A deal.

This is an additional benefit for the acquirer. Thus, hypothesis 5 on the positive influence of relational capital on the performance of mergers and acquisitions in developed markets cannot be rejected. In hypothesis 6, the impact of relational capital on the performance of mergers and acquisitions in emerging markets tends to be statistically insignificant.

We also identify a positive relationship between the structural capital of the target company and M&A performance; however, it is statistically insignificant for both developed and emerging markets. Thus, hypotheses 7 and 8 are rejected. The main reason for the positive influence of structural capital is that acquisition of patented technologies, and the scientific and technological knowledge bases of the target company (which

complement the technology and knowledge base of the acquirer) stimulates an increase in R&D efficiency and, consequently, makes mergers and acquisitions more successful [54]. The obtained results correspond with other research studies in which authors find a positive influence of various components of structural capital, such as patents [32], investments in R&D [38; 40; 41], and the level of know-how [31], on M&A performance for companies in emerging as well as developed markets.

In order to test hypothesis 9 and its sub-hypotheses we test four regression models based on the overall sample using our new variables, as described in the section dedicated to our research methodology. The results of the regressions are presented in Table 4.

Table 4. Results of comparative analysis of impact of intellectual capital on M&A performance in developed and emerging capital markets (see complete results in Appendix 5)

Variables	Model 1	Model 2	Model 3	Model 4
Constant	-0.03595	-0.05118	-0.05909	-0.04749
IC	0.07721*	0.07021*	0.08175*	0.06983*
HC	0.04997*	0.05186**	0.05407**	0.04745*
RC	0.00722**	0.00653*	0.00707*	0.00626*
SC	0.00511*	0.00532	0.00642	0.00502*
IC_Dev	-0.00256			
HC_Dev		-0.00411**		
RC_Dev			0.00028	
SC_Dev				0.00185*
ROA	0.19848	0.12979	0.15997	0.16892
Payment	0.06390*	0.06603*	0.07080	0.05867**
Val	0.15728*	0.16580	0.15716	0.16990
ASize	-0.00412	0.00508	0.00644	0.00464
Share	0.06887	0.05406	0.06790	0.06417
US	0.00617	0.00676	0.00780	0.00714
G	-0.00503	-0.00498	-0.00443	-0.00519
F	-0.00464	-0.00446	-0.00410	-0.00497
IT	-0.00714	-0.00767	-0.00641	-0.00653
UK	0.00638	0.00778	0.00719	0.00638
J	0.00087	0.00077	0.00083	0.00080
CH	-0.00198	-0.00182	-0.00152	-0.00161
IN	-0.00818	-0.00781	-0.00742	-0.00786
BR	-0.00936	-0.00870	-0.00826	-0.00927
M	-0.01354	-0.01273	-0.01199	-0.01232
INN	0.01263	0.01317	0.01111	0.01079
R ²	0.3831	0.3929	0.3869	0.4016

Significance levels: *10%; **5%; *** 1%.

Source: authors' own calculations.

As we can see from Table 4, the coefficient of the variable IC_Dev is negative ($\beta = -0.00256$). This confirms that a positive effect of intellectual capital is higher for companies from emerging markets than for companies from developed markets. However, the p-value is 0.2808, which implies the statistical insignificance of this coefficient and, correspondingly, the insignificance of the difference in the influence of intellectual capital on the performance of mergers and acquisitions for both markets. Thus, hypothesis 9 is rejected.

When checking model 2, the variable HC_Dev has a negative coefficient, which is statistically significant at the 5% level ($\beta = -0.00411$). This means that there are differences in the effect of human capital for two sub-samples, and these differences are significant. The negative sign preceding the coefficient means that the degree of impact of human capital on the success of a transaction is higher for companies from emerging markets than for companies from developed markets. Consequently, hypothesis 9a cannot be rejected at the 5% significance level. The obtained results may stem from the fact that developed markets are characterised by a high intensity of human capital, and mergers and acquisitions between competing companies may demotivate employees to develop innovative solutions. Consequently, a positive effect from the acquisition of such human capital will be lower [55].

The coefficient of the variable which describes the joint influence of relational capital and the dummy variable turned out to be positive, but low ($\beta = 0.00028$). This means that relational capital influences the performance of mergers and acquisitions a little more when the acquirer operates in a developed market. However, this difference is statistically insignificant (p-value = 0.1879). Thus, hypothesis 9b is rejected. In other words, we can conclude that relational capital equally influences M&A performance for companies in both emerging and developed capital markets. Relations with customers and their loyalty are important for every company, irrespective of the market the company belongs to. This is because such customers significantly define the company's operations. That is why acquisition of firms with a high level of relational capital, expressed in a large customer database and customer trust, improves M&A performance irrespective of the acquirer's country of origin [56].

The results of the testing of model 4 shows that the coefficient of the fictitious variable SC_Dev is positive ($\beta = 0.00185$) and significant at the 10% level. This proves that for companies from developed markets, structural capital has a stronger impact on performance of mergers and acquisitions than for companies from emerging markets, although we initially anticipated the opposite effect. Thus, hypothesis 9c is rejected. The obtained result, from our point of view, may be explained by the fact that when companies from emerging markets enter developed markets, they may acquire firms with which they have no technological interconnection, or with which such interconnection is very low. Technology and patents represent a specific part of the structural capital of the target

company, and do not influence the innovative activity of the acquirer. This reduces the positive effect of structural capital of the target company for acquirers from emerging markets when compared with acquirers from developed markets [57].

Conclusion

In this paper, in contrast to the previous studies, we conduct a comparative analysis of the influence of intellectual capital in general and its key components (human, relational, and structural) on the performance of mergers and acquisitions in developed and emerging capital markets. We compare developed markets based on firms from the USA, Canada, Germany, Great Britain, France, Italy, and Japan, and emerging markets based on firms from China, India, Brazil, and Malaysia.

Based on the evaluation of empirical data, we show that the performance of mergers and acquisitions for an acquirer positively and statistically significantly depends on the intellectual capital of the target company, irrespective of the market in which the acquirer operates. The larger the intellectual capital of the target firm, the higher the level of performance of mergers and acquisitions for an acquirer both in developed and emerging capital markets. Each component of intellectual capital of the target company increases the performance of the acquisition: the higher the level of human, relational, or structural capital of the target company, the higher the M&A performance for the acquirer. We have managed to prove a positive and statistically significant relationship for acquirers in developed capital markets for human and relational capital. For emerging markets, we have proven this only for human capital.

The results of the analysis performed allow us to conclude that in general, transactions initiated by companies from developed countries create a greater value for the acquirer than transactions in which the acquirer operates in an emerging capital market.

The comparative analysis of influence of intellectual capital and its components on M&A performance allows us to make the following conclusions:

There is no significant difference in the influence of intellectual capital on M&A performance for developed and emerging capital markets.

Relational capital has the same impact on M&A performance for companies in emerging markets, as well as in developed markets.

The influence of human capital on M&A performance is higher for acquirers from emerging capital markets, while the influence of structural capital is higher for acquirers from developed capital markets.

Further areas of potential research may include an enlargement of the sample of countries, the use of alternative methods of measurement of intellectual capital and its components to test our research hypotheses, the use of a different time period or duration, and the study of

the influence of the intellectual capital of the acquirer on the performance of mergers and acquisitions. It seems reasonable to expand the scope of the future research by adding domestic mergers and acquisitions and by avoiding studying mergers and acquisitions only in developed capital markets. The chosen indicator of measurement of acquisition performance may also influence the obtained results. In future research studies, it may conceivably be replaced with ROA, ROE, and EVA.

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Appendices

Appendix 1. Correlation matrix: checking for multicollinearity

	IC	HC	RC	SC	ROA	Payment	Val	Asize	Share	US	G	F	IT	UK	J	CH	IN	BR	M	INN	
IC	1																				
HC	0.022	1																			
RC	0.1871	0.3399	1																		
SC	0.0484	0.3254	0.4187	1																	
ROA	0.01	-0.231	-0.022	0.0936	1																
Payment	-0.205	0.1623	0.2068	0.1373	0.4177	1															
Val	0.3027	0.0826	0.2107	0.162	-0.075	-0.182	1														
Asize	0.4103	0.125	0.348	0.2738	0.2887	0.2758	0.4731	1													
Share	-0.174	-0.3	-0.205	0.181	-0.084	0.0116	-0.371	-0.016	1												
US	0.0213	0.1735	0.2126	0.1407	0.2198	0.2229	-0.105	-0.015	-0.254	1											
G	0.1811	0.1404	-0.053	0.0582	0.103	0.1512	0.201	0.3084	-0.147	-0.118	1										
F	-0.153	0.3999	0.4319	0.1704	0.0632	0.1048	0.2121	0.2768	0.0096	-0.082	-0.055	1									
IT	-0.198	-0.109	-0.064	-0.103	0.1544	0.1521	0.179	0.0912	-0.17	0.119	-0.08	-0.058	1								
UK	0.1531	0.0034	0.2139	0.0255	-0.18	-0.378	0.0353	0.1293	0.0227	-0.147	-0.1	-0.065	-0.104	1							
J	0.2701	0.1908	-0.097	-0.162	0.2018	-0.094	-0.405	-0.343	0.0567	-0.149	-0.111	-0.06	-0.111	-0.125	1						
CH	0.206	0.1333	0.0218	0.0488	-0.109	-0.028	-0.004	0.078	0.4091	-0.174	-0.118	-0.082	-0.123	-0.151	-0.147	1					
IN	0.1357	0.1344	-0.081	0.2533	-0.035	0.1512	0.1602	0.2817	-0.101	-0.12	-0.08	-0.053	-0.081	-0.112	-0.11	-0.117	1				
BR	-0.206	0.0825	0.4389	-0.011	-0.178	0.1514	-0.066	0.0712	0.0626	-0.115	-0.087	-0.064	-0.079	-0.109	-0.103	-0.119	-0.08	1			
M	-0.056	0.1127	0.0839	-0.09	-0.221	-0.367	0.1183	-0.181	-0.159	-0.082	-0.057	-0.038	-0.049	-0.072	-0.069	-0.082	-0.063	-0.055	1		
INN	0.2349	0.0023	0.0083	0.0437	0.2131	-0.043	0.1089	-0.107	0.1962	0.3423	0.1262	0.3022	0.1262	0.2294	0.2869	0.2706	-0.192	-0.184	-0.127	1	

Source: authors' calculations.

Appendix 2. Calculation of VIF: checking for multicollinearity

Variable	VIF	1/VIF
ROA	3.962	0.2524156
Val	3.055	0.3273397
SC	2.937	0.3404734
HC	2.453	0.4076633
IC	2.331	0.4290367
Share	1.872	0.5343265
RC	1.838	0.5440498
Payment	1.811	0.5523271
Asize	1.764	0.5670479
US	1.680	0.5951308
UK	1.645	0.6078579
F	1.596	0.6266431
IT	1.586	0.6304499
IN	1.557	0.6421820
G	1.468	0.6812418
INN	1.292	0.7741054
BR	1.205	0.8295493
M	1.176	0.8503839
CH	1.027	0.9734574
J	0.937	1.0669077
Average VIF	1.860	0.5377581

Source: authors' calculations.

Appendix 3. Chow test: checking whether the sample should be divided into two subsamples

RSS_{ALL}	69.861	$F = \frac{(RSS_{ALL} - (RSS_{DEV} + RSS_{EM})) / (k + 1)}{\frac{RSS_{DEV} + RSS_{EM}}{n - 2(k + 1)}} = 4,2$ $F \sim F_{k+1; n-2(k+1)} \quad F_{0,05; 4,2} \approx 1,9$ $F_{\text{observed}} > F_{\text{critical}} \quad (4,2 > 1,9)$
$RSS_{DEVELOPED}$	32.014	
$RSS_{EMERGING}$	23.052	
F-statistics	4.2	

Source: authors' calculations.

Appendix 4. Results of testing influence of intellectual capital in developed and emerging capital markets

Developed markets						
Regression statistics						
Multiple R	0.650069449					
R ²	0.422590289					
Adjusted R ²	0.331704051					
Standard error	0.557947064					
Observations	115					
Analysis of variance						
	Df	SS	MS	F	Significance F	
Regression	16	22.3278804	1.395492525	4.482719064	5.29742E-06	
Residual	98	30.50788272	0.311304926			
Total	114	52.83576313				
	Coefficient	Standard error	t-stat.	P-value	Lower 95%	Upper 95%
Const	-0.049052704	0.064540388	-0.760031131	0.29748133	-0.177488075	0.079382668
IC	0.069500549	0.035422527	1.962043764	0.059088491	-0.000990281	0.139991378
HC	0.049776291	0.023105425	2.154311823	0.040280718	0.003796495	0.095756087
RC	0.008954912	0.004612202	1.941569984	0.061429748	-0.000223369	0.018133194
SC	0.008669882	0.005948884	1.457396411	0.137673874	-0.003168397	0.020508162
ROA	0.22598316	0.140772211	1.605310861	0.110104102	-0.054153541	0.506119861
Payment	0.07535423	0.031181945	2.416598112	0.022670046	0.013302159	0.137406302
Val	0.148254118	0.101285492	1.463725115	0.136421426	-0.053304011	0.349812247
Asize	0.004336407	0.002723167	1.592413378	0.112362295	-0.001082695	0.009755509
Share	0.0357393	0.039120416	0.913571585	0.261513527	-0.042110327	0.113588928
US	0.008158412	0.013768079	0.592559923	0.333361552	-0.019240065	0.035556889
G	-0.005279547	0.007605143	-0.694207522	0.312136783	-0.020413781	0.009854687
F	-0.004936586	0.005477385	-0.901267065	0.264455057	-0.015836582	0.005963409
IT	-0.006846426	0.009246728	-0.740416114	0.30191103	-0.025247415	0.011554562
UK	0.005455365	0.007226993	0.754859592	0.298653956	-0.008926351	0.019837081
J	0.000877834	0.000782397	1.121980988	0.211552164	-0.000679135	0.002434803
INN	0.012586112	0.007912941	1.590573189	0.112686815	-0.003160641	0.028332865

Emerging markets

Regression statistics

Multiple R	0.646698602
R ²	0.418219082
Adjusted R ²	0.301862898
Standard error	0.641332657
Observations	79

Analysis of variance

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	13	19.21871904	1.478363003	3.594300434	0.000854268
Residual	65	26.73499252	0.411307577		
Total	78	45.95371157			

	<i>Coefficient</i>	<i>Standard error</i>	<i>t-stat.</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Const.	-0.036032117	0.03275391	-1.10008597	0.216202742	-0.101212399	0.029148164
IC	0.072059789	0.038906979	1.852104432	0.072808789	-0.0053651	0.149484678
HC	0.053884229	0.022620336	2.3821145	0.025102452	0.008869762	0.098898697
RC	0.008186552	0.005543443	1.476799014	0.133739908	-0.002844901	0.019218004
SC	0.007824628	0.005116609	1.529260501	0.123782081	-0.002357424	0.01800668
ROA	0.168040505	0.17732544	0.947639015	0.252692604	-0.18483712	0.52091813
Payment	0.045681323	0.031452929	1.452371045	0.13852677	-0.016910005	0.10827265
Val	0.179255758	0.098288801	1.823765841	0.076562674	-0.016338956	0.374850471
Asize	0.008538914	0.0095688	0.892370449	0.265905003	-0.010502997	0.027580825
Share	0.071348506	0.04989555	1.429957311	0.143000308	-0.027943638	0.17064065
CH	0.029706669	0.023651548	1.256013736	0.180118538	-0.017359911	0.07677325
IN	0.009067883	0.007567697	1.198235455	0.193248361	-0.005991834	0.0241276
BR	0.007361809	0.010300945	0.714673167	0.306947419	-0.013137072	0.02786069
INN	0.011375011	0.013809459	0.823711609	0.282107035	-0.016105811	0.038855834

Source: authors' calculations.

Appendix 5. Comparative analysis of influence of intellectual capital on performance of mergers and acquisitions in developed and emerging capital markets (for hypothesis 9)

<i>Regression statistics</i>						
Multiple R	0.618938277					
R ²	0.383084591					
Adjusted R ²	0.307763524					
Standard error	0.624148487					
Observations	194					
<i>Analysis of variance</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	21	41.60766614	1.981317435	5.086021805	2.38863E-09	
Residual	172	67.00454931	0.389561333			
Total	193	108.6122155				
	<i>Coefficient</i>	<i>Standard error</i>	<i>t-stat.</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Const.	-0.035948979	0.037649705	-0.954827633	0.252163063	-0.110871892	0.038973934
IC	0.07721218	0.039949669	1.932736422	0.06210821	-0.002287661	0.15671202
HC	0.049970463	0.042017273	1.837629485	0.074110826	-0.006402194	0.160826553
RC	0.00721667	0.003379221	2.135601794	0.041412804	0.000492021	0.01394132
SC	0.005111264	0.002991993	1.708314237	0.092946381	-0.000842802	0.01106533
ROA	0.198475639	0.229655049	0.864233726	0.273843091	-0.258537909	0.655489186
Payment	0.063902348	0.034100237	1.873956143	0.069344449	-0.003957123	0.13176182
Val	0.157278763	0.081629755	1.926733256	0.062820605	-0.005164449	0.319721974
Asize	-0.004116709	0.003573384	-1.152047693	0.204887321	-0.011227744	0.002994326
Share	0.068871007	0.048534046	1.419024637	0.145558214	-0.027711744	0.165453758
Dev_IC	-0.00255924	0.003066045	-0.834703955	0.280810567	-0.00866067	0.00354219
US	0.006174563	0.004347557	1.420237145	0.145309337	-0.002477077	0.014826202
G	-0.005028748	0.00706166	-0.7121198	0.308804075	-0.01908145	0.009023955
F	-0.004642301	0.00577431	-0.803957632	0.287988236	-0.016133177	0.006848576
IT	-0.007138163	0.005416077	-1.317958109	0.167032521	-0.017916157	0.003639831
UK	0.006378967	0.003979417	1.602990325	0.110460975	-0.001540073	0.014298008
J	0.000866138	0.001593011	0.543711251	0.34337411	-0.002303953	0.004036229
CH	-0.001976816	0.001539379	-1.284164205	0.174509823	-0.00504018	0.001086549
IN	-0.008175792	0.011340693	-0.720925281	0.306856402	-0.030743771	0.014392187
BR	-0.009358891	0.02182808	-0.428754665	0.363203383	-0.052796771	0.034078988
M	-0.013543681	0.015551514	-0.870891453	0.272263682	-0.044491194	0.017403833

<i>Regression statistics</i>						
Multiple R	0.626850219					
R ²	0.392941197					
Adjusted R ²	0.318823552					
Standard error	0.619142325					
Observations	194					
<i>Analysis of variance</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	21	42.67821395	2.032295902	5.301587757	7.48874E-10	
Residual	172	65.93400151	0.383337218			
Total	193	108.6122155				
	<i>Coefficient</i>	<i>Standard error</i>	<i>t-stat.</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Const.	-0.051177265	0.062873324	-0.813974226	0.28565944	-0.176295179	0.073940649
IC	0.070211376	0.029070055	1.783970568	0.081570155	-0.005989287	0.109709533
HC	0.051860123	0.029498425	2.380173694	0.024147873	0.01150951	0.128913242
RC	0.006529514	0.003342176	1.953671236	0.059670638	-0.000121417	0.013180444
SC	0.005317155	0.00355994	1.493607823	0.130667959	-0.001767126	0.012401436
ROA	0.129787061	0.081975244	1.583247021	0.113958977	-0.033343675	0.292917797
Payment	0.066028826	0.039133528	1.687269945	0.096290243	-0.011846895	0.143904547
Val	0.165803885	0.105399291	1.573102475	0.115782291	-0.043940704	0.375548474
Asize	0.00508021	0.004327285	1.173994803	0.199734135	-0.003531087	0.013691506
Share	0.05405547	0.03913164	1.381375012	0.153392793	-0.023816494	0.131927434
Dev_HC	-0.004107939	0.001677807	-2.448397105	0.020572579	-0.007446775	-0.000769102
US	0.006762765	0.004219466	1.602753844	0.110502476	-0.001633972	0.015159501
G	-0.004980674	0.006519192	-0.764001657	0.297172912	-0.017953866	0.007992519
F	-0.004460577	0.003700249	-1.205480339	0.192407868	-0.011824073	0.002902918
IT	-0.007670648	0.011686724	-0.656355684	0.320852145	-0.030927228	0.015585933
UK	0.007779737	0.005684119	1.368679388	0.156080097	-0.00353166	0.019091134
J	0.000768344	0.000741538	1.036147859	0.232553247	-0.000707318	0.002244005
CH	-0.00181669	0.001237513	-1.468016887	0.135679472	-0.004279342	0.000645961
IN	-0.007812249	0.006086849	-1.283463548	0.174666281	-0.019925078	0.004300581
BR	-0.008700966	0.012580059	-0.691647513	0.313286602	-0.033735283	0.016333351
M	-0.012725535	0.017191227	-0.740234244	0.302546517	-0.046936077	0.021485007
INN	0.013173431	0.012819446	1.027613164	0.234609565	-0.012337266	0.038684129

<i>Regression statistics</i>						
Multiple R	0.622011662					
R ²	0.386898507					
Adjusted R ²	0.312043092					
Standard error	0.622216179					
Observations	194					
<i>Analysis of variance</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	21	42.02190403	2.001043049	5.168610824	9.74051E-08	
Residual	172	66.59031142	0.387152973			
Total	193	108.6122155				
	<i>Coefficient</i>	<i>Standard error</i>	<i>t-stat.</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Const.	-0.059093191	0.070673599	-0.836142387	0.28047273	-0.199733653	0.08154727
IC	0.081752246	0.046083844	1.773989315	0.083013268	-0.009954603	0.173459095
HC	0.054065694	0.022309173	2.423473696	0.021823501	0.00967044	0.098460949
RC	0.007069251	0.004087773	1.729364782	0.089679705	-0.001065418	0.01520392
SC	0.006419828	0.004326921	1.483694254	0.132596975	-0.002190745	0.015030402
ROA	0.159966898	0.103625833	1.543697103	0.121166008	-0.046248509	0.366182305
Payment	0.070801381	0.046890304	1.509936478	0.127525224	-0.022510325	0.164113087
Val	0.157159698	0.102293054	1.536367258	0.122530622	-0.046403478	0.360722875
Asize	0.006435034	0.004338199	1.483342198	0.132665769	-0.002197983	0.015068051
Share	0.06790184	0.051560196	1.316943007	0.167255104	-0.034702951	0.17050663
Dev_RC	0.000276836	0.000226019	1.224836471	0.187947242	-0.000172941	0.000726614
US	0.007804307	0.006024447	1.295439475	0.171999874	-0.004184343	0.019792956
G	-0.00443361	0.00673363	-0.658427905	0.320413921	-0.017833532	0.008966313
F	-0.004100883	0.005101618	-0.803839657	0.288015606	-0.014253102	0.006051337
IT	-0.00641162	0.009746883	-0.657812342	0.320544179	-0.025807918	0.012984678
UK	0.007193147	0.00773087	0.930444742	0.258029764	-0.008191284	0.022577579
J	0.000834763	0.000727375	1.14763801	0.205926887	-0.000612713	0.002282238
CH	-0.001522611	0.001340809	-1.135591354	0.208773464	-0.00419082	0.001145599
IN	-0.007424845	0.012293894	-1.058753047	0.331663844	-0.031889694	0.017040004
BR	-0.00825558	0.013669406	-0.603945748	0.331663844	-0.035457698	0.018946539
M	-0.011988551	0.016148028	-0.742415806	0.302056345	-0.044123128	0.020146025
INN	0.011112975	0.007588055	1.464535346	0.136369276	-0.003987255	0.026213204

<i>Regression statistics</i>						
Multiple R	0.633749396					
R ²	0.401638297					
Adjusted R ²	0.328582508					
Standard error	0.614691216					
Observations	194					
<i>Analysis of variance</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	21	43.62282529	2.077277395	5.497692947	2.62727E-10	
Residual	172	64.98939016	0.377845292			
Total	193	108.6122155				
	<i>Coefficient</i>	<i>Standard error</i>	<i>t-stat.</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Const.	-0.047492782	0.070426636	-0.674358244	0.317019592	-0.187641787	0.092656223
IC	0.069828053	0.0364885	1.913700265	0.06438795	-0.002784063	0.142440169
HC	0.047447143	0.02573176	1.843913657	0.073270013	-0.003759059	0.098653345
RC	0.006262081	0.003271781	1.913967137	0.064355571	-0.000248763	0.012772925
SC	0.005018485	0.002537753	1.977531246	0.056980238	-3.16426E-05	0.010068612
ROA	0.168924486	0.17021581	0.992413602	0.24309943	-0.169804977	0.507653948
Payment	0.058671241	0.023820057	2.463102476	0.019863162	0.011269328	0.106073154
Val	0.169903533	0.158736831	1.070347264	0.224330764	-0.145982761	0.485789826
Asize	0.004640388	0.002948824	1.573640258	0.115685193	-0.001227771	0.010508547
Share	0.064166616	0.072898602	0.88021737	0.270046628	-0.080901603	0.209234835
Dev_SC	0.001845255	0.001078859	1.710375624	0.092623035	-0.000301675	0.003992184
US	0.007144595	0.004459708	1.602032197	0.110629182	-0.001730223	0.016019413
G	-0.00519258	0.010324534	-0.502936002	0.350811519	-0.025738402	0.015353242
F	-0.004973451	0.004761321	-1.044552766	0.230529614	-0.014448479	0.004501577
IT	-0.006525007	0.009704139	-0.672394231	0.317440465	-0.025836244	0.012786229
UK	0.006375776	0.006191604	1.029745542	0.234095678	-0.005945515	0.018697067
J	0.000795572	0.000891758	0.892138683	0.267205255	-0.000979027	0.002570171
CH	-0.001610255	0.001751348	-0.919437456	0.260672425	-0.005095437	0.001874928
IN	-0.007858714	0.007049685	-1.114760976	0.213716764	-0.021887588	0.00617016
BR	-0.009266674	0.017762027	-0.521712644	0.347438678	-0.044613107	0.026079759
M	-0.012316435	0.025011782	-0.492425311	0.352659467	-0.062089881	0.037457012
INN	0.010787998	0.007432361	1.451490084	0.138970774	-0.0040024	0.025578395

Internal Capital Markets in Russian Business Groups: Evidence from Corporate Investments

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Internal Capital Markets in Russian Business Groups: Evidence from Corporate Investments

Abstract

The purpose of this paper is to assess the impact of the internal capital markets on the investments of Russian group-affiliated companies mediated by the degree of the firms' financial constraints.

Our research is prompted in line with the question of motivation for the use of internal capital markets, and whether the reallocation of intragroup funds help mitigate financing constraints of group members and facilitate their investments. We apply the generalised method of moments (GMM) to estimate investments models based on data for 514 Russian companies affiliated with 48 business groups over the period from 2014 to 2018. Following the existing studies based on the Euler equation model, we analyse the relationship between subsidiaries' investments and such factors as lagged investments, sales, leverage, asset profitability and liquidity as well as the size of both subsidiaries and their groups.

The results indicate that leverage and profitability of business groups positively influence the investment activity of subsidiaries. These findings support our hypotheses that the internal capital markets of Russian business groups are active and help mitigate the financial constraints of affiliated companies. Subsidiaries' investment activity is negatively related to their asset profitability which is typical for propping practices followed by controlling shareholders. The results also show some evidence of the positive relationship between subsidiaries' cash flows and investments, demonstrating that the internal capital markets in Russia do not eliminate the financial constraints of group-affiliated companies.

The novelty of this work is our demonstration how the internal capital markets of business groups operate and influence corporate activities, which has not been sufficiently shown in prior research. Our findings may be useful for managers seeking for mechanisms to increase the financial resource availability for large and medium companies in the context of sanctions, macroeconomic instability and the less-developed financial markets in Russia.

Key words: internal capital market, business group, financing constraints, investments, tunneling, propping

JEL classification: G31, G32, O16

Introduction

Wide access to capital markets is a prerequisite for comprehensive development and stable functioning of any company. In recent years, the uncertainty of economic policy in Russia and the insufficient depth of the country's financial system have adversely affected the availability of external finance for domestic enterprises. Anti-Russian sanctions and the continued risks of new restrictive measures have forced Russian companies to adapt to the limited funding available from foreign investors. Due to the combination of these factors, the amount of capital available to domestic enterprises is often insufficient to satisfy their financial needs, making it vital to search for tools that can mitigate financial constraints. It implies not only the key role of retained earnings and other internal funds of individual companies, but also the growing significance of internal capital markets of business groups that allow their participants to attract temporarily free resources from affiliated companies to finance their activities.

Business groups have gained prominence in many countries, both developing and developed. Corporate groups also occupy strong positions within the Russian economy. As of the end of 2019, all public companies whose shares are included in the Moscow Exchange quotation lists 1 and 2 are group affiliated. In the view of the Gaidar Institute, the search for an institutional model for the economic growth consolidation in Russia was periodically focused either on private business facilitation or state expansion in the economy, while financial-industrial groups have been consistently exerting a predominant impact on the economic development of the country [40, p. 30].

When the availability of external financing is limited, the access of group-affiliated companies to internal capital market resources becomes a source of strategic advantage. Both the volumes and efficiency of their investments may depend on the in-depth understanding of the internal capital market operation. Though recent studies by V. Cherkasova and O. Teplova have examined the impact of financing constraints on investments of Russian companies based on the investment-cash flow sensitivity analysis [13; 14], they did not consider any differences between group-affiliated and stand-alone companies. Therefore, the role of internal capital markets in easing financing constraints to facilitate corporate investment in Russia still requires examination. Thus, the aim of this study is to assess the impact of internal capital markets of Russian business groups on the investment activity of participating companies at the current stage of economic development in Russia.

Our research results contribute to a more detailed understanding of the internal capital market as a potential mechanism for the pooling of intragroup funds by financially constrained firms to accept profitable investment opportunities, especially in the context of the ongoing anti-Russian sanctions, general macroeconomic instability, and inert development of financial markets.

Prior research provides ambiguous evidence as to the impact that internal capital markets pose on the investment

efficiency of foreign business groups. Studies by T. Hoshi and co-authors, R. Lensink and co-authors, and M. Deloof showed that internal capital markets relax financial constraints of group-affiliated firms by substituting for external capital markets [29; 16] and enhancing access to external funds [36]. Results reported by H. Almeida and co-authors [2] and A. Ang and co-authors [3] demonstrated that internal capital markets facilitate profitable investment under adverse funding shocks faced by group-affiliated companies. J. Mota and M. dos Santos argue that internal capital markets of modern business groups in the euro area stimulate investments of subsidiaries with higher growth opportunities [37]. Alternatively, after an analysis of investment in Russian financial-industrial groups, E. Perotti and S. Gelfer concluded that the extent of intragroup funds redistribution might allow private benefits extraction by controlling shareholders [39]. Research by A. Gautier and M. Hamadi revealed that active internal capital markets may cause low performing subsidiaries to rely more on group financing, hence encumbering investment efficiency of business groups [23].

In Russia, integration processes and business groups were often the focus of academic research in the 2000s owing to the studies by S. Avdasheva, V. Dementiev, T. Dolgopyatova, and V. Golikova [4; 17], but despite their continuing economic significance, these topics gradually lost the attention of researchers. Russian studies on internal capital markets of that period, carried by D. Brodskiy and A. Kulemin investigated the links between investment strategies of domestic business groups and internal capital markets [9] and the impact of internal capital markets on value creation in business groups [33]. More than a decade ago A. Shumilov and N. Volchkova examined the efficiency of internal capital markets in Russia with the use of the cash flow sensitivity of cash approach [43], revealing that internal capital markets failed to boost liquidity of group-affiliated companies at the turn of the 20th and 21st centuries. Whether the effects of internal capital markets have changed since then is still an open research question that motivated this study.

The remainder of this paper is organised as follows. The literature review develops a general perspective on the motives for the use of internal capital markets and the impact that their functioning may impose on the financial constraints and investments of group-affiliated companies. The next two sections specify the hypotheses and the investment model used in the empirical part of the study. The section on the empirical research begins with an explanation of the sample construction, then provides descriptive statistics about the firms and variables analysed and presents the results of our estimations. The final section summarises the main findings.

State of knowledge

The notion of an internal capital market refers to the allocation of capital resources between different business units (in a multidivisional company) or subsidiaries (in

a business group) [8, p. 39], or financial linkages among group companies [25, p. 760]. From the turn of the 20th-21st centuries there is an ongoing debate on whether internal capital markets of business groups create value for group members [31] or, on the contrary, undermine it due to opportunistic actions taken by controlling shareholders [28]. The nature of the internal capital market impact on the value of group-affiliated companies is largely determined by the motives behind its usage provided by the controlling owner of the group. The literature identifies three broad (not necessarily mutually exclusive) motives for the redistribution of financial resources within group-affiliated companies: (1) to tunnel funds out of firms at the expense of minority shareholders; (2) to support group members that are subject to financial distress; (3) to fund more profitable investment projects within the business group [25, p. 766]. These motives correspond with theoretical hypotheses about the nature of reallocation of funds on an internal capital market, which are: (1) tunneling, (2) propping, and (3) financing advantage (mitigation of financing constraints) hypotheses.

Group companies can be differentiated by the size of their financing deficits (surpluses) and by the cash-flow rights of the controlling shareholder, indicating the fraction of dividends the shareholder receives. Significant differences in the cash-flow rights among companies within a business group create strong motives for tunneling, i.e. extraction of private benefits by the controlling shareholder and expropriation of the minority ones [19]. Propping aims at saving a financially distressed company for the sake of future profit sharing and/or stealing [22, p. 744]. The research on tunneling and propping shows that these practices regularly co-exist in business groups as controlling shareholders are prone to tunnel funds from financially solid companies and inject resources into financially weaker ones [38]. The financing advantage hypothesis implies that a controlling shareholder reallocates intragroup funds towards financially constrained companies. In this case, the direction of financial flows within an internal capital market is determined not by the differences in the controlling shareholder's cash-flow rights among companies, but by the differences in internal funds availability among the companies.

A group of researchers have examined the motives for the active usage of internal capital markets based on the data on intragroup lending, by investigating the origin and settlement of such loans. The findings of G. Jiang and colleagues shed light on widespread tunneling practices through intragroup loans in Chinese listed companies [27], as the balances of other receivable (incorporating intragroup loans) scaled by total assets proved to be larger for small, less profitable and more leveraged companies, i.e. those companies where the benefits of tunneling should outweigh its costs. By investigating the internal debt concentration of Belgian private business group affiliates, N. Dewaelheyns and C. Van Hulle demonstrated that subsidiaries with limited access to external financing are on average characterised with the highest use of inter-

nal debt in line with the financial advantage hypothesis [18]. D. Buchuk and co-authors studied internal capital markets of Chilean business groups by analysing the lending relationships between group-affiliated companies and showed that intra-group lending in Chile is more consistent with the financing advantage hypothesis and significantly less with tunneling [10]. Recent analysis of intra-group loan payable and receivable balances of Russian public companies provided evidence that the controlling shareholders of Russian business groups combine both financing advantage and tunneling strategies while making decisions on the financing of their business [32].

In this study, we apply an even more widely-used framework to investigate the mechanism of internal capital market functioning that is based on the analysis of its effects on the financing constraints of group affiliated companies.

In a world without market imperfections, company investment decisions would be determined by investment opportunities (often measured by Tobin's Q) and the demand for the company's products. Introduction of capital market frictions into investment research in the 1980s showed that a firm's investment can be limited by the financial resources it generates, as capital market imperfections lead to external funds being more expensive than company's internal resources [20]. If the gap in the cost of internal and external finance is small, fluctuations in the volume of internal funds available can be relatively easily smoothed out by raising additional external finance. However, when such a gap becomes significant, financially constrained companies should have a higher sensitivity of investment to fluctuations in operating cash flows. Financially constrained companies are interpreted as firms exhausting most of their internal funds, and thus rejecting profitable investments due to the existing discrepancy between internal and external sources of finance [34]. The bigger the wedge between the cost of internal and external funds, the more financially constrained the company is [30, p. 173].

As the topic of financial constraints and their impact on corporate investment grew in popularity, some researchers started to include conglomerates first, then group-affiliated companies into samples to test whether a company's access to an internal capital market matters in terms of investment. Hoshi, Kashyap and Scharfstein were among the first to analyse the impact of internal capital market on the financial constraints of companies affiliated with a business group [29]. Their study revealed that group-affiliated Japanese companies in the 1960s-1980s showed on average a lower sensitivity of investment to cash flow in comparison to stand-alone firms, thus demonstrating that internal capital markets helped mitigate the underinvestment problem caused by external capital market imperfections. Though focusing on multidivisional companies instead of business groups, H. Shin and R. Stulz showed that internal capital markets help implement profitable investment projects that otherwise would be foregone due to asymmetric information and agency costs. They also suggested to consider an internal capital market efficient if it allows to real-

locate limited funds in a way that maximises shareholder wealth [41, p. 533], i.e. channels the financing resources to divisions with better investment opportunities.

Existing studies show that the functioning of internal capital market as a mechanism for easing financial constraints of business group-affiliated companies leads to several key consequences. First of all, provided that the use of internal capital markets is led by the financing advantage motive, investments in fixed assets of group affiliated companies turn out to be less sensitive to fluctuations in the firms' own cash flows, but respond to changes in the aggregate cash flows of other companies in the group [34; 26].

Consequently, internal capital markets can alleviate the adverse effects of financial shocks, especially of financial crises [1]. Secondly, under limited external financing, due to the access to inside funds, those business groups that are organised as pyramids may enjoy financing advantages in relation not only to new investment projects, but also to the setting up of new firms [7]. Finally, the positive effects from the functioning of the internal capital markets are especially significant for more capital-intensive firms [6].

In Russia, according to S. B. Avdasheva, already in the first half of the 2000s internal capital markets of those Russian business groups that did not pay dividends on ordinary shares developed more actively [5, p. 40] in line with the financing advantage hypothesis. Currently the existence of cross-subsidisation practice in Russian business groups is noted by A. V. Zhiganov and A. Y. Yudanov [44].

According to V. A. Cherkasova, the degree of financing constraints of Russian companies is affected by their asset liquidity as well as by firm size, leverage, dividend payout ratio and asset tangibility [13].

Research hypotheses

Based on the analysis of existing studies we put forward a set of hypotheses to be tested within the empirical part of the research.

Hypothesis 1. Consistent with an active internal capital market assumption, investments of subsidiaries are positively affected by the cash flows of their group [3; 23; 26] (*H1p*). Assuming that the use of internal capital markets is driven by the financing constraints mitigation motive, the subsidiary investments are less sensitive to the company's own cash flow (a proxy for the company's internal funds) than to the group cash flow (a proxy for the intragroup funds available through the internal capital market) measured as the cash flow of the parent company indicated in its consolidated statements (*H1s*).

The investment modelling of group-affiliated companies enables us to analyse indirectly the internal capital market efficiency by which we imply the reallocation of intragroup funds towards group members with higher investment opportunities. In this regard, we formulate our expectations as follows:

Hypothesis 2. In line with the financing advantage motive for the use of internal capital markets, there is a negative relationship between the investment opportunities of a

parent company and the investments of subsidiaries [23; 25] (*H2p*) and a positive relationship between the firm's own investment opportunities and its investments [24] (*H2s*).

We also test a range of hypotheses about control variables.

Hypothesis 3. There is a positive relationship between the investments of a subsidiary and the sales of the subsidiary itself (*H3s*) as well as of its parent company (*H3p*) in line with the accelerator effect [34].

Hypothesis 4. Investments of subsidiaries are positively affected by the size of the subsidiaries themselves (*H4s*) and their parent companies (*H4p*) as larger companies and business groups are expected to have a preferential access to external financing and thus be less financially constrained.

Hypothesis 5. Subsidiary investments in fixed assets are adversely affected by the share of long-term financial assets of the company (*H5*).

Hypothesis 6. There is a positive relationship between the investments of a subsidiary and the cash reserves of the subsidiary itself (*H6s*) as well as of its parent company (*H6p*), as higher liquidity should facilitate investment, all other things being equal.

Hypothesis 7. Investments of subsidiaries are adversely affected by the leverage of the subsidiaries themselves (*H7s*) and their parent companies (*H7p*) as higher indebtedness may lead to lower creditworthiness and decrease the future availability of funds to finance investments.

Hypothesis 8. Corporate investment in fixed assets positively depends on its level in the previous reporting period (*H8*).

Methodology

To assess the impact of the internal capital markets on financial constraints and investments of Russian group-affiliated companies we apply a classic framework based on the investment - cash flow sensitivity analysis, i.e. evaluate empirically the influence of operating cash flows (as well as traditional financial determinants) on the investments in fixed assets. Existing studies widely employ two types of investment models, namely the Q model of investment and the Euler equation model [24]. As estimation of the replacement cost of assets appears to be an ambiguous practical task creating a risk of Tobin's Q mismeasurement and obtaining biased results, we apply the Euler equation model in this study. It implies that a firm's current investments are determined by its past investments and various financial factors.

Thus, we estimate the following model:

$$\begin{aligned}
 I_{i,t} = & \beta_0 + \beta_1 Sales_{i,t}^s + \beta_2 Sales_{i,t}^h + \beta_3 SIZE_{i,t-1}^s \\
 & + \beta_4 SIZE_{i,t-1}^h + \beta_5 Cash\ Flow_{i,t}^s + \beta_6 Cash\ Flow_{i,t}^h + \\
 & + \beta_7 ROA_{i,t}^s + \beta_8 ROA_{i,t}^h + \beta_9 Financial\ Assets_{i,t-1}^s + \\
 & + \beta_{10} Cash_{i,t-1}^s + \beta_{11} Cash_{i,t-1}^h + \beta_{12} Debt_{i,t-1}^s + \\
 & + \beta_{13} Debt_{i,t-1}^h + \beta_{14} I_{i,t-1} + \varepsilon_{i,t} (1)
 \end{aligned}$$

In the equation (1) i is the number of a firm; t is a year and the superscripts s and h denote a company itself (a subsidiary) and its parent (holding) company, correspondingly; $I_{i,t}$ is the investments in fixed assets divided by beginning of year total assets; $TA_{i,t-1}$ denotes beginning of year total assets of a company; $SIZE_{i,t-1}$ is measured as a natural logarithm of beginning of year total assets; $CashFlow_{i,t}$ denotes net cash generated by operating activities divided by beginning of year total assets; $ROA_{i,t}$ is return on total assets calculated as net profit divided by average annual total assets; $ROA_{i,t}$ net cash generated by operating activities divided by beginning of year total assets; $FinancialAssets_{i,t-1}^s$ denotes non-current financial assets scaled by total assets at the beginning of year t ; $Sales_{i,t}$ is measured as sales divided by beginning of year total assets; $Cash_{i,t-1}$ and $Debt_{i,t-1}$ are cash and cash equivalents and total liabilities scaled by total assets at the beginning of year t , correspondingly; $\varepsilon_{i,t}$ is an error term.

Following a widely-used approach, [e.g. in 26; 13; 3], we apply the ratio of annual investments in fixed assets to beginning of year total assets of a company to characterise corporate investment activity. We construct two different dependent variables by measuring investments in fixed assets: (1) as an annual increase in the carrying value of fixed assets (based on a statement of financial position – *Investment SFP*) and (2) as an acquisition of non-current assets (based on a statement of cash flows – *Investment SCF*).

We do not use ordinary least squares to estimate our models due to possible endogeneity problems and measurement errors that are typical for investment studies. All specifications of the investment model in equation (1) are estimated with the use of the generalised method of moments (GMM) with asymptotic standard errors for potential heteroskedasticity. We apply GMM difference (GMM-DIF) as well as GMM system (GMM-SYS) estimators, but, following L. Laeven, we use only two-step GMM estimates since: (1) they are more efficient than one-step estimates, and (2) only they allow Sargan test on over-identifying restrictions to be heteroskedasticity-consistent [35, p. 21].

Empirical research

By testing the above-mentioned hypotheses in our empirical analysis, we aim to address the following two questions: (1) Are Russian group-affiliated companies using internal capital market to reallocate financial resources? (2) If yes, are internal capital markets efficient? To find relevant answers we built empirical investment models using a set of 514 Russian group-affiliated companies and the period from 2014 to 2018.

As a first step to identify Russian business groups we formed a list of parent companies whose subsidiaries were subsequently checked for the possibility to be included in the research sample. Within this step we analysed all Russian companies with ordinary shares included in the

Moscow Exchange quotation list as of 01.10.2019. We then excluded the following from this initial set:

- Banks, insurance and real estate companies;
- Companies in which the state and/or municipalities either control at least 20% of shares or have a special right (a so-called ‘golden share’) to participate in corporate governance;
- Companies that did not publish their annual financial statements under IFRS at least once within the period of 2013-2018.

State-controlled business groups were left outside of our analysis for two reasons. First, it is bureaucrats who perform control over companies with predominant state participation and their goals are often determined by political interests rather than public welfare. Second, while control rights in state-controlled companies are highly concentrated, cash flow rights are widely dispersed among all taxpayers [42, p. 768].

The second step of the sample construction was aimed at identifying subsidiaries to be further included in the study. We analysed ownership chains of the parent companies selected at the first step with the use of ‘Company Connections’ tool offered by the SPARK database. We identified 800 firms registered no later than December 2013 and controlled (with ownership stakes no less than 50% of shares along the whole ownership chain) by selected public companies during 2013-2018.

Following other studies [e.g. 15; 24] we then excluded 169 companies with zero values of total assets and/or total revenue at the end of at least one year within 2013-2018 as they might have undergone restructuring or bankruptcy. We also excluded companies with zero book value of fixed assets at the beginning or end of at least one year within the period under investigation.

As a result, the final sample for our empirical study included 514 Russian companies affiliated with 48 non-state business groups. The five-year study period chosen (2014-2018) and the sampling design allowed us to obtain a balanced panel data set of 2570 firm-year observations. Table 1 presents information on the industry structure of the sample:

Table 1. Industry structure of the sample

Industry (of a parent company)	Parent companies	Subsidiaries
Metals and mining	12	232
Consumer goods and trade	8	49
Power industry	7	12
Chemical industry	5	52
IT & Telecommunications	4	11

Industry (of a parent company)	Parent companies	Subsidiaries
Oil & Gas	4	90
Mechanical engineering	3	8
Construction and development	3	25
Transport	1	2
Finance	1	33
Total	48	514

Source: Author's own calculations.

Table 2 presents descriptive statistics of the variables used. It shows that on average parent companies are more profitable than their subsidiaries (7.2% versus 5.2%, correspondingly), have a higher level of liquidity captured by both cash flows (13% of total assets versus 5%) and cash reserves (7.4% versus 5.0%) and are slightly more levered (with debt-to-assets ratios of 70.3% versus 66.2%, correspondingly).

Subsequently, we also resorted to mitigation of the possible impact of extreme observations in the sample as an additional fourth step to improve the quality of the results as well as to check their robustness. There are two common approaches for reducing the effect of outliers that imply:

Table 2. Descriptive statistics of tested variables

Variable	Mean	Median	Standard deviation	Minimum	Maximum
Size (subsidiary)	13.7	13.6	2.44	7.24	21.2
Size (parent)	19.4	19.6	1.71	13.7	22.6
Cash Flow (subsidiary)	0.05	0.03	0.335	-6.10	2.62
Cash Flow (parent)	0.130	0.133	0.107	-0.331	2.28
ROA (subsidiary)	0.052	0.038	0.237	-3.24	1.50
ROA (parent)	0.072	0.069	0.165	-1.51	0.647
Financial assets (subsidiary)	0.054	0.000	0.147	0.000	0.976
Cash (subsidiary)	0.050	0.009	0.106	0.000	0.912
Cash (parent)	0.074	0.053	0.070	-0.003	0.357
Debt (subsidiary)	0.662	0.574	0.709	0.000	9.05
Debt (parent)	0.703	0.614	0.500	0.087	5.02
Sales (subsidiary)	2.32	1.37	2.87	0.000	54.2
Sales (parent)	0.881	0.803	0.613	0.002	9.27

Source: Author's own calculations.

- 1) using some rule of thumb to remove observations that are considered as outliers (in this case a sample is reduced based on the parameters set by a researcher, that are maximum/minimum regressor values allowed);
- 2) data winsorisation that refers to replacing extreme values by the maximum and/or minimum data at the threshold.

The first approach (data trimming) is often used in empirical modeling, including investment analysis. M. Deloof deleted firm-year observations with zero revenue values and/or with the value of revenue growth higher than 100% [16]. L. Laeven excluded observations with non-positive investments or fixed assets as well as observations with extreme values of the investment-to-capital ratio (those beyond the range of 0.1 – 0.5), the sales-to-capital ratio (those beyond the range of 0.1 – 10), the cash flow-to-capital ratio (those beyond the range of 0.01 – 1) [35]. J. H. Mota and coauthors deleted companies with negative operating profit, EBIT [37]. Though this approach is widely used in research, we do not apply it in this study because it forms a specific, nonrandom sample, negatively affecting the results representativeness. Therefore, to eliminate outliers we apply the second approach and winsorise data at the 1% and 99% levels following another group of researchers [21; 2; 3].

To address the issue of potential multicollinearity in the model we estimated a correlation matrix (Table 3). Absolute values of all pair correlation coefficients are less than 0.5 and show the absence of close relationships between explanatory variables. It enables us to assess the risks of multicollinearity as low.

Table 3. Correlation matrix for the variables used

	Investment SFP	Investment SCF	Size (s)	Size (p)	Cash Flow (s)	Cash Flow (p)	Sales (s)	Sales (p)
Investment SFP	1.0	0.832	-0.037	-0.009	-0.013	0.034	-0.026	0.051
Investment SCF		1.0	-0.018	0.012	-0.006	0.051	-0.030	-0.000
Size (s)			1.0	0.351	0.065	0.062	-0.290	-0.064
Size (p)				1.0	0.065	0.302	-0.021	-0.256
Cash Flow (s)					1.0	0.028	0.033	0.027
Cash Flow (p)						1.0	0.008	-0.129
Sales (s)							1.0	0.151
Sales (p)								1.0

	ROA (s)	ROA (p)	Financial assets (s)	Cash (s)	Cash (p)	Debt (s)	Debt (p)
Investment SFP	-0.001	0.040	-0.003	0.071	-0.021	-0.007	-0.001
Investment SCF	-0.004	0.021	-0.021	0.049	-0.012	-0.006	0.006
Size (s)	0.101	0.025	0.234	-0.254	-0.140	-0.181	-0.060
Size (p)	0.109	0.209	-0.025	0.000	-0.074	-0.183	-0.313
Cash Flow (s)	0.363	0.048	-0.008	-0.023	-0.028	-0.097	-0.050
Cash Flow (p)	0.050	0.304	-0.036	0.029	0.233	-0.119	-0.133
Sales (s)	0.071	0.083	-0.169	0.083	0.038	0.245	-0.062
Sales (p)	0.025	-0.015	-0.018	-0.070	0.001	0.133	0.072
ROA (s)	1.0	0.119	0.009	-0.079	-0.034	-0.170	-0.080
ROA (p)		1.0	-0.074	0.052	0.240	-0.127	-0.344
Financial assets (s)			1.0	-0.102	-0.018	-0.107	0.150
Cash (s)				1.0	0.242	-0.067	-0.001
Cash (p)					1.0	-0.044	0.015
Debt (s)						1.0	0.210
Debt (p)							1.0

Comments: (s) stands for subsidiary, (p) stands for parent company.

Source: Author's own calculations.

We first use unwinsorised data to estimate several specifications of the investment model differing on the estimators (either GMM-DIF or GMM-SYS) and the dependent

variable (either Investment SFP or Investment SCF) used. Table 4 reports the estimation results:

Table 4. Investment model estimation results (unwinsorised data)

	(1)	(2)	(3)	(4)
Dependent variable	Investment SFP	Investment SFP	Investment SCF	Investment SCF
Estimator	GMM-DIF	GMM-SYS	GMM-DIF	GMM-SYS
Lagged investment	0.0061 (0.0059)	0.0143 *** (0.0046)	-0.0004 (0.0033)	0.0019 (0.0048)
Size (subsidiary)	-0.1418 *** (0.0382)	0.0007 (0.0020)	-0.0297 ** (0.0130)	0.0022 ** (0.0010)
Size (parent)	0.1176 *** (0.0336)	0.0008 (0.0020)	0.0403 ** (0.0163)	0.0044 *** (0.0014)
Cash Flow (subsidiary)	-0.0008 * (0.0005)	0.0002 (0.0003)	0.0001 (0.0004)	0.0002 (0.0003)
Cash Flow (parent)	0.0439 (0.0897)	0.0742 (0.0633)	-0.0261 (0.0305)	0.0050 (0.0209)
ROA (subsidiary)	-0.0108 (0.0435)	-0.0158 (0.0275)	-0.0315 (0.0242)	-0.0153 (0.0129)
ROA (parent)	0.0384 (0.0374)	0.0315 (0.0291)	-0.0239 (0.0184)	-0.0081 (0.0114)
Financial assets (subsidiary)	0.0112 (0.0415)	-0.0179 (0.0166)	0.0999 (0.0822)	-0.0012 (0.0271)
Cash (subsidiary)	0.0127 (0.0538)	0.0072 (0.0194)	0.0056 (0.0216)	-0.0190 (0.0142)
Cash (parent)	-0.2056 (0.1336)	-0.1019 * (0.0566)	0.0499 (0.0798)	0.0754 ** (0.0340)
Debt (subsidiary)	-0.0483 (0.0324)	-0.0128 ** (0.0055)	-0.0032 (0.0082)	-0.0066 (0.0043)
Debt (parent)	-0.0108 (0.0320)	-0.0013 (0.0055)	0.0316 (0.0215)	0.0003 (0.0039)
Sales (subsidiary)	-0.0059 * (0.0033)	0.0013 (0.0009)	0.0066 (0.0051)	0.0024 (0.0015)
Sales (parent)	0.0708 ** (0.0286)	0.0253 *** (0.0075)	0.0077 (0.0107)	0.0022 (0.0034)
Constant	0.0003 (0.0101)	-0.0395 (0.0448)	0.0026 (0.0065)	-0.0872 *** (0.0272)
Year dummies	YES	YES	YES	YES
Observations	1542	2056	1542	2056
AR(1): p-value	0.1677	0.1585	0.0957	0.0979
AR(2): p-value	0.1357	0.4434	0.4255	0.4735
Sargan test: p-value	0.6943	0.8946	0.2507	0.1159
Wald test of joint significance: p-value	0.0288	0.0013	0.5170	0.0000
Wald test (year dummies): p-value	0.9426	0.3310	0.5752	0.3824

Comments: * - significance at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level. Standard errors in parentheses.

Source: Author's own calculations.

We consider the consistency of estimations by presenting a Sargan test on over-identifying restrictions. As all the p-values reported are 0.11 and above, the null hypothesis implying the validity of instruments is not rejected even at the 10% significance level. The reliability of results also depends on the assumption that the error terms do not exhibit autocorrelation. Both the first-order and second-order serial correlation tests indicate inexistence of the autocorrelation problems. We also report Wald tests for joint significance of all the parameters. As the null hypotheses refer to insignificance, low p-values (for models 1, 2 and 4) imply joint significance for all independent variables.

Estimation results provide evidence that companies affiliated with larger business groups invest more in fixed assets, *ceteris paribus* (in line with *H4p*). At the same time, it is impossible to draw unambiguous conclusions on the influence of a company's size on its investment activity (*H4s*) as two models out of four reported a negative effect, while the rest two models imply a positive impact and no significant effect, respectively. There is some empirical

evidence that business group lagged sales have a positive impact on the investments in fixed assets of affiliated companies (in support of *H3p*). Contradictory evidence is obtained on the relationship between the level of cash holdings in a business group and investments made by its affiliated companies (*H6p*).

The first model estimation results imply that a company's investment activity is adversely affected by its leverage measured as total debt-to-assets ratio (*H7s*) as well as by company's own operating cash flows. Considering the insignificance of company's operating cash flows in other estimated models, this evidence implies that Russian group-affiliated companies did not experience significant financial constraints during 2014-2018.

To further investigate the investment patterns of Russian companies we continue our modelling by winsorising all explanatory variables (except for both company and group size) at the top and bottom 1% of their distribution. Using the data without outliers we re-estimate the models (1)-(4), the results are provided in the Table 5:

Table 5. Investment model estimation results (winsorised data)

Dependent variable	(1) Investment SFP	(2) Investment SFP	(3) Investment SCF	(4) Investment SCF
Estimator	GMM-DIF	GMM-SYS	GMM-DIF	GMM-SYS
Lagged investment	0.1074 ** (0.0472)	0.1424 *** (0.0418)	0.2306 *** (0.0805)	0.2283 *** (0.0562)
Size (subsidiary)	-0.0672 *** (0.0138)	0.0014 (0.0012)	-0.0224 *** (0.0065)	0.0025 *** (0.0008)
Size (parent)	0.0743 *** (0.0206)	-0.0002 (0.0016)	0.0329 ** (0.0137)	0.0020 * (0.0011)
Cash Flow (subsidiary)	-0.0104 (0.0146)	-0.0050 (0.0127)	0.0226 * (0.0120)	0.0200 ** (0.0094)
Cash Flow (parent)	0.0016 (0.0503)	0.0016 (0.0334)	-0.0236 (0.0335)	0.0107 (0.0232)
ROA (subsidiary)	-0.0033 (0.0272)	-0.0038 (0.0179)	-0.0329 ** (0.0146)	-0.0214 ** (0.0101)
ROA (parent)	0.0466 * (0.0264)	0.0511 ** (0.0226)	0.0001 (0.0168)	0.0029 (0.0141)
Financial assets (subsidiary)	0.0098 (0.0290)	-0.0070 (0.0126)	0.0077 (0.0176)	-0.0285 *** (0.0086)
Cash (subsidiary)	0.0110 (0.0388)	0.0091 (0.0214)	0.0248 (0.0247)	-0.0024 (0.0144)
Cash (parent)	-0.0914 (0.0826)	-0.0552 (0.0377)	-0.0131 (0.0506)	0.0378 (0.0240)
Debt (subsidiary)	-0.0086 (0.0153)	-0.0089 * (0.0047)	-0.0131 * (0.0075)	-0.0094 *** (0.0033)

	(1)	(2)	(3)	(4)
Debt (parent)	0.0169 (0.0249)	0.0015 (0.0061)	0.0299 * (0.0161)	-0.0002 (0.0043)
Sales (subsidiary)	-0.0017 (0.0026)	0.0027 *** (0.0009)	0.0034 * (0.0021)	0.0012 * (0.0006)
Sales (parent)	0.0125 (0.0125)	-0.0021 (0.0034)	0.0041 (0.0096)	-0.0013 (0.0030)
Constant	-0.0047 (0.0059)	-0.0057 (0.0350)	0.0008 (0.0034)	-0.0473 ** (0.0205)
Year dummies	YES	YES	YES	YES
AR(1): p-value	0.0000	0.0000	0.0000	0.0000
AR(2): p-value	0.4071	0.7615	0.6697	0.5473
Sargan test: p-value	0.9760	0.9791	0.6032	0.4619
Wald test of joint significance: p-value	0.0000	0.0000	0.0011	0.0000
Wald test (year dummies): p-value	0.5503	0.1198	0.8789	0.5617

Comments: * - significance at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.
Standard errors in parentheses.

Source: Author's own calculations.

Even after reducing the effects of outliers the obtained results confirm the *H8* hypothesis implying that corporate investment in fixed assets positively depends on its level in the previous reporting period. Again, there is strong evidence that, all other things being equal, companies affiliated with larger business groups invest more (in line with *H4p*). Still the results do not allow us to make unambiguous conclusions on the effect of company's size on the investment activity (*H4s* is not confirmed). While group sales as a corporate investment factor appeared to lose its significance in the models based on winsorised data, the effect of companies' own sales on investment turned to be significantly positive in most models (in support of *H3s*). In contrast to the models (1) - (4) that provided controversial evidence on the relationship between group cash reserves and the investments of group members, estimation results for models (5)-(8) based on winsorised data do not support existence of any significant effects of cash reserves (*H6s* and *H6p* not confirmed).

In support of the financing constraints mitigation motive, our modeling results show that investment activity of individual firms is subject to a negative impact of company leverage (in line with *H7s*) and a positive influence of group leverage (contrary to *H7p*). The more debt a company raises to finance its operations, the higher is the cost of using external funds and the degree of financial constraints. At the same time, a higher debt ratio of a whole business group may not cause a significant increase in the cost of borrowing of affiliated companies, due to the co-insurance effect [11; 12], and debt capital attracted by a business group can be further distributed to group partici-

pants with larger investment opportunities with the use of internal capital market.

Models (7) and (8) also reveal a positive impact of a company's operating cash flow on its investment activity that can be explained by limiting investment to available internal funds due to higher costs of external financing, i.e. by the presence of financial constraints [37, p.11]. Considering that there is no significant influence of cash flows of parent companies on the investments of subsidiaries, we can state that hypotheses *H1p* and *H1s* (being consistent with the financing constraints mitigation motive) are declined, and internal capital markets of Russian business groups, though active, still fail to eliminate financial constraints of affiliated companies.

Finally, the second group of models in total demonstrates that profitability (considered as a proxy of investment opportunities) of a business group has a positive impact on the investments of participating companies, while profitability of a company itself is negatively related to the level of investment in fixed assets (contrary to *H2p* and *H2s*, correspondingly). It can be interpreted as an evidence for cross-subsidisation taking place in Russian business groups and is more consistent with the proping motive for the internal capital market usage [41, p. 533]. This finding contradicts the internal capital market efficiency assumption implying that intragroup financing operations should stimulate investment activity of more profitable group members. As such, this does not match the financing advantage motive behind the use of internal capital markets.

Conclusion

Nowadays, mechanisms for easing financing constraints are of special importance for Russian companies, due to the limited availability of internal and external sources of funds (caused by an unstable macroeconomic situation in Russia and sanctions imposed against a significant range of firms). In this regard, internal capital markets have a good potential to mitigate financial constraints of group-affiliated companies and to help boost the investments of the most profitable business units within business groups. In this study, we aimed at checking whether the use of internal capital markets in Russia is indeed motivated by this so-called financing advantage strategy of controlling shareholders, and not by tunneling or propping practices. To do so we have examined the determinants of investment activity of Russian group-affiliated companies to assess whether they are consistent with the financing constraints mitigation motive.

Summing up the empirical findings based on a wide range of Russian subsidiaries over the period from 2014 to 2018, we state that the investment activity of Russian group-affiliated companies is dependent on both company and group characteristics. In support of the financing advantage motive behind the use of internal capital markets, subsidiary investments in fixed assets are adversely affected by a company leverage as a higher debt burden increases the degree of financial constraints by enlarging the gap between the costs of internal and external funds. Investments of subsidiaries are also positively influenced by their own sales in line with the accelerator effect. There is also evidence that investments in fixed assets demonstrate a positive dependency on their own lagged values and are negatively related to the share of long-term financial assets serving as an alternative investment option.

At the same time, subsidiaries' investments are also influenced by group characteristics, namely leverage and investment opportunities, proxied by ROA. In general, the significance of group factors shows that internal capital markets of Russian business groups are functioning, and actively enabling affiliated companies to use intragroup funds to finance investments. We find that members of more leveraged business groups invest more, *ceteris paribus*. This can be explained by the co-insurance effect, and thus should be interpreted in favor of the financing constraints mitigation motive.

Nevertheless, the efficiency of internal capital markets is not proven, as subsidiaries' investments are negatively affected by the companies' own asset profitability. This finding is more consistent with the propping motive for the internal capital market usage. Meanwhile, some evidence of a positive impact of company's operating cash flow on its investments in addition to the insignificance of cash flows of parent companies for the investments of subsidiaries demonstrate that the internal capital markets of Russian business groups, though active, still fail to eliminate the financial constraints of affiliated companies, and thus do not fully contribute to facilitation of investments.

Summing up, we conclude that currently the use of internal capital markets of Russian non-state business groups is driven partly by the financing constraints mitigation motive, partly by the propping motive, and should exert ambiguous effects on the intra-group funds allocation efficiency.

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Improving Loan Loss Provisioning Framework as a Driver of Economic Growth

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Abstract

Various aspects of credit risk have been studied by many researchers. Scientists and practitioners consider different credit risk assessment methods depending on its application, e.g. to determine capital adequacy, to make loss loan provisions, or to estimate its influence on the interest rate. At the same time, there are almost no studies that consider the relationship between loan loss provisioning framework and loan decisions. The study seeks to 1) understand how the practices and procedures of loan loss provisioning impact total gross loans of Russian banks, and 2) identify constraints for insufficient levels of lending and factors that can foster lending.

With the use of an econometric model we estimate a quantitative effect of credit portfolio on the growth of loan loss provisions. We base our model on data derived from financial statements of 400 Russian credit institutions between 2014 and 2019. In addition to our empirical model, we analyze statistical data on the development of the Russian banking system and compare the loan loss provisions in Russian and foreign financial organizations. The estimates are based on Russian official statistics and financial statements of banks within and outside Russia. The study reveals that the existing credit risk assessment method that rests on the regulations provided by the Bank of Russia is responsible for excessive loan loss provisions accumulated by Russian banks. This, in turn, affects the volumes of bank loans.

In our research we have arrived at the conclusion that the existing loan loss provisioning is excessive. Current loan loss provisions do not correspond to real lending losses. They negatively affect the financial results of credit institutions, resulting in ungrounded refusals to lend, which in turn limits economic growth. These results support the rationale for reinventing the existing framework of loan loss provisioning.

Key words: banks, lending, loan loss provisions, banking supervision, credit risk, economic growth

JEL classification: E52, G21, G32

Introduction

In seeking ways to expand their activities, many businesses face the problem of resource scarcity. For most enterprises in different industries, bank loans represent the primary way to address their financial shortfalls. The breakdown of the liabilities of Russian business organizations (except small enterprises) shows that the total amount of bank loans is 1.2 times greater than the amounts payable to vendors and customers (as of

01.01.2019, and on average from 2010 onwards; according to official statistics) [1, 2]. The estimates are summarized below, in Figure 1.

Currently, a distinct feature of the Russian banking sector is its excess liquidity. As of the beginning of the year 2018, structural liquidity surplus has never fallen below 2 trillion rubles (Figure 2) [3]. Considering the scale of this situation, one might ask- why should these tremendous financial resources not be channeled into real economy?

Figure 1. Breakdown of the obligations of non-financial entities (excluding small enterprises) in Russia from 2010 to 2019

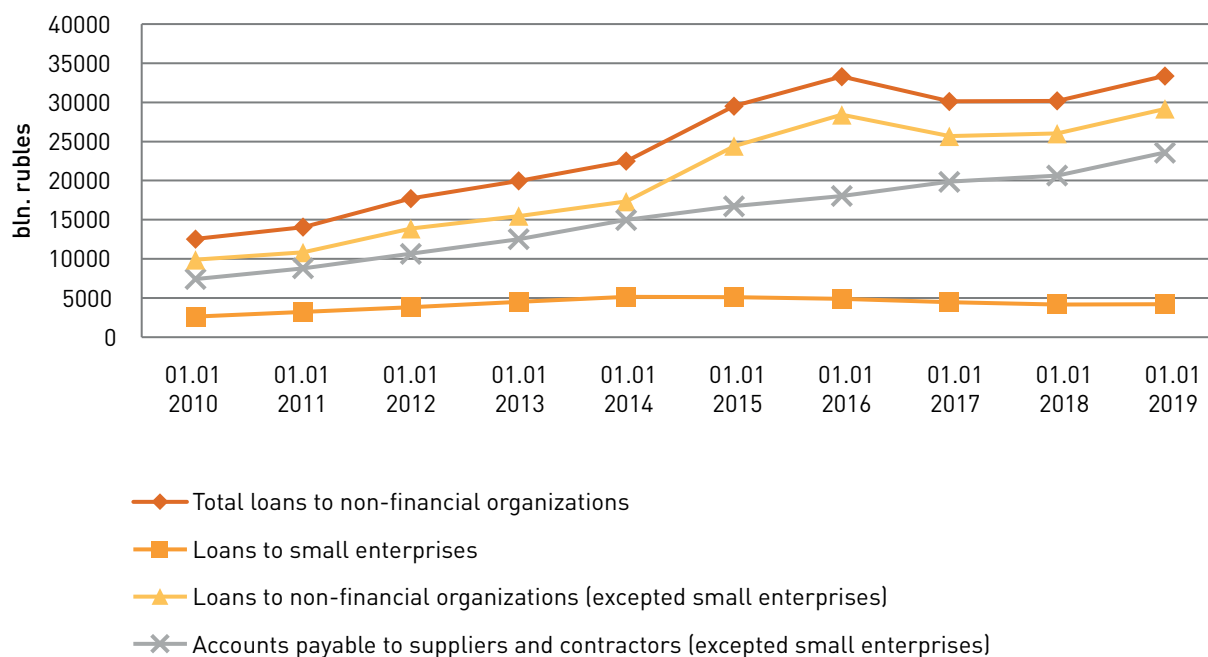
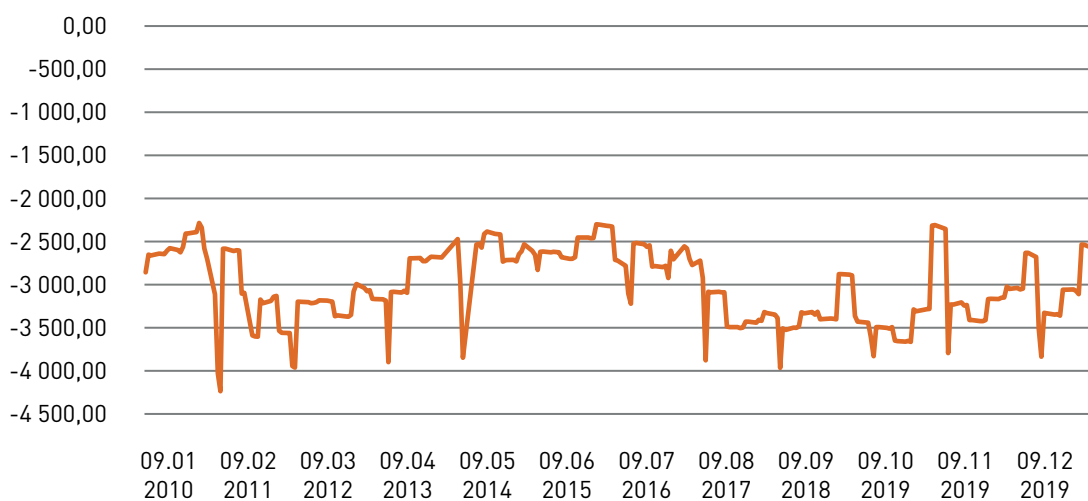


Figure 2. Structural deficit (+) / surplus (-) of liquidity in Russian banking in 2018-2019, bln. rubles



There are in fact several convincing possible reasons for this. We believe that along with the regulator’s requirements towards a capital adequacy ratio, an important factor that hinders credit growth is a faulty assessment of credit risks. Overcautious behavior of credit institutions

in terms of loan loss provisioning severely constrains individual business projects. At the same time, from a wider perspective, such activity may be seen to constrain the kind of national economic development that is so strongly needed today.

Literature Review

From the perspective of this study, two aspects of the present subject needs to be highlighted. The first aspect concerns whether the increase in total gross loans can produce growth in major economic development dimensions and, consequently, whether pursue this increase should be pursued. If the answer is affirmative, there arises a second question: can loan loss provisioning serve as a tool to spur lending?

In support of the first assumption, S. Andrushin [4] states that banks have significant resource potential to provide access to loan facilities for the real sector of the economy and consumers. Alternatively, B. Shtulberg and N. Sharshavaya conclude that lending does not show direct impact on economic growth [5]. We will refer to the analysts of the Bank of Russia who believe that in certain periods, including in the first quarter of 2019, it was only the growth of consumer lending that allowed for positive values in GDP growth [6].

Studies of the relationship between bank performance and macroeconomic indicators are becoming even more relevant, taking into account the current volatility in financial sector.

Exploring the relationship between the financial standing of banks and their impact on the real economy, T. Kapan and C. Minoiu consider bank equity level as a factor that allows for rapid growth in gross loans during post-crisis periods [7].

J. Fidrmuc and R. Lind consider the potential impact on macroeconomic performance generated by higher capital requirements, arising from the adoption of Basel III. They conclude that tougher requirements around capital result in a negative, although moderate, effect on GDP [8].

E. Tikhomirova [9] points to possible negative consequences of excessive lending regulation. With risks tending toward being overestimated, banks include their increased costs in the price of loans, which negatively affects consumer demand and slows down lending trends.

The impact of different external and internal factors on interest rates has been addressed in detail by M. Osborne, A. Berndt, N. Gorelaya [10, 11, 12] and other authors. Most interesting from our perspective are the studies of W. Edelberg, C.Y. Lim, E. Lee, A. Kausar and M. Walker [13, 14], with an emphasis on risk-based loan pricing. Banks are likely to apply higher interest rates to the borrowers whom they rank as low quality and, as these studies confirm, this is largely a result of expenses recognition (primarily, those expenses generated through loan loss provisioning).

In their work "Does bank efficiency influence the cost of credit?", A. Shamshur and L. Weill suggest an interesting view of credit rates policy. The authors see the possibility of lowering interest rates on loans by banks operating at lower cost (more efficiently). This set of circumstances produces the greatest impact on small and medium-sized enterprises [15].

The task of developing adequate risk assessment methods is in the spotlight of many Russian and foreign experts. Many writers emphasise the importance of using not only financial indicators, but also quality and individual risk factors [16]. We are in full agreement with this point. Different credit risk assessment frameworks (including those involving behavior dimensions) are described in [17, 18].

One interesting idea has been put forward by S. Yamanaka [19]. The author suggests using purchase orders made by borrowing firms as relevant information to measure corporate credit risks. On the other hand, we have to avoid excessive indicators and restrict their number in order to avoid their interrelation.

Another concern for corporate risk assessment is the choice between accounting and market-based models [20, 21]. The authors of the cited works lean towards conventional methods based on accounting statements.

Scoring models also remain popular. O. Amat, R. Manini, M. A. Renart build their scoring model around conventional financial indicators of company performance [22]. A similar approach is adopted by T. Kossova and E. Kossova [23]. Yonghan Ju and So Young Sohn add other indicators, such as technological factors, human resources, etc. [24]. Such suggestions to streamline risk assessment methods can be applied in banking practices. However, despite the availability of a developed toolkit for risk assessment, loan loss provision, where an important risk indicator, is still exposed to subjective manipulations by bank management [25]. We note that such manipulations may be carried out to comply with the regulator's requirements, thus the values do not necessarily match the reality of credit risks, but they do have an adverse effect on bank financial performance. Some authors consider loan loss provisions as a manipulating tool to even out the fluctuations of financial results, which leads to a biased external evaluation of banks' sustainability [26].

Many authors consider risk assessment from the perspective of the Basel Committee on Banking Supervision [27, 28, 29]. Russian authors are seriously concerned about the possibility to harmonise the challenges of economic growth and banking sustainability that are at the forefront of Basel III Accord. According to E. Meshkova, this can only be achieved through improving the practices of estimated loan losses and creating provisions for bad loans [28, p. 31].

Here we should notice that currently Russian banks are likely to estimate credit risks in the following occasions: (1) to create provisions for loan losses; (2) to calculate capital adequacy ratio (when ranking assets by the level of risks); (3) starting from 01.01.2019, to form estimated provisions for expected credit losses in accordance with the requirements of IFRS 9 "Financial Instruments" [30]. Each of these cases calls for a different evaluation method: (1) following the Bank of Russia's Regulation "On the Procedure for Making Loss Provisions by Credit Institutions for Loans and Similar Debts" № 590-P of 28.06.2017 (hereafter referred to as 'Regulation 590-P')

[31]; (2) following the Bank of Russia's Instruction № 199-I, dated November 29, 2019, "On Banks' Required Ratios and Capital Adequacy Buffers for Banks with a Universal Licence" (hereafter referred to as 'Instruction 199-I') [32]; (3) following IFRS 9 "Financial Instruments", introduced by Order of the Ministry of Finance of the Russian Federation dated June 27, 2016 №. 98n [30].

The borrower's financial standing and debt service quality forms the basis to assign loans to particular quality categories in accordance with Regulation 590-P. Depending on the quality category, the size of the provision is estimated, which can be reduced taking into account the collateral value of the loan. In compliance with IFRS, the amount of the estimated reserve depends on the stage of loan impairment and is supposed to conform to the expected credit losses over the next 12 months or for its entire life period.

The provision component (i.e. creation and reconstitution) in cases (1) and (3) affects the financial result of the bank.

A credit risk assessment aimed at determining capital adequacy has no direct impact on the financial result. The method also differs from the cases described above. The risk factor for weighing assets when calculating capital adequacy ratios following Instruction 199-I depends on the class of the counterparty (previously designated according to the category of assets). The updated version of Instruction 199-I is sharply focused on supporting investment lending and SME lending, which is reflected in setting reduced risk ratios for these types of financing.

Of a similar purpose (setting capital requirements) are the Basel III risk assessment standards that evolved considerably compared to Basel II [33]. Concerning the issues under consideration, the revision of standardised approaches to credit risk assessment (in order to increase their sensitivity to risk) has been completed, and the use of the Advanced Internal Ratings-Based (A-IRB) approach has been limited.

As for the transition to Basel standards, it was as late as 2015 that the regulator developed implementation documents to enable banks with assets equal to or exceeding 500 billion rubles to use the IRB approach: Foundation IRB (F-IRB) or A-IRB, by prior authorisation of the Bank of Russia. According to F-IRB, a bank uses its own assessment of the probability of default (PD); according to A-IRB, a bank uses its own assessment of the probability of default (PD), loss given default (LGD) and exposure at default (EAD). Banks are also authorised to assess the effective remaining maturity of loans at their discretion [34, 35]. Currently, only two banks in Russia (Sberbank PJSC and Raiffeisenbank JSC) use the IRB approach to assess credit risks. The Bank of Russia plans to introduce the changes envisaged by Basel III into banking regulation by 2022.

We should note that the Bank of Russia today faces a two-way challenge: on the one hand, the transition to Basel III standards, and on the other, foster economic development through the implementation of an appropriate monetary

policy, using key rate as a major tool. Indeed, the key rate currently directs interest rate movements on the deposit and credit markets, but the rate is ultimately refined after consideration of many factors, including the adequacy of credit risk assessment.

Therefore, the regulations provided by The Bank of Russia continue to be the point of reference for Russian banks [31]. The inconsistencies of these documents are likely to distort real risk profiles, and thus they deserve detailed consideration.

Methodology

As part of the research, we carried out a desktop analysis of relevant foreign and Russian literature on the correlation between total gross loans within the banking sector and general economic indicators of credit risk assessment. The research was conducted using a combination of the observation method, empirical analysis, the comparison method, and correlation and regression analyses. The estimates are based on the data from the Federal State Statistics Service (Rosstat) and the Bank of Russia, annual reports of credit institutions available via the Internet.

Our process revealed several data inconsistencies found not only between the statements provided by different banks, but also within the massive amount of official statistical information and the information from the Bank of Russia. For example, some statements disregard those loans which are 90 days past due as a separate category, while such loans are commonly qualified as non-performing, as opposed to those less than 90 days that are seen as a delay of technical nature. In addition, some statements do not provide information specifically on small enterprises' payables. The Bank of Russia does not distinguish small business as a separate lending category in its loan book, while Rosstat presents them separately. To make the data comparable, where possible, we had to do special calculations. Where this is impossible, the remaining gaps or inconveniences are explicitly stated.

As part of our study, we also calculated the quantitative dependence of loan loss provisions on lending and overdue debts. The database for the research included information from 400 credit institutions accumulated for the period from 2014 to 2019, available on the website www.banki.ru [36]. We also used data from the financial statements of credit institutions compiled by the analytical center of www.banki.ru – one of the largest independent portals on the Runet. Our sample includes the top 400 banks with the largest loan portfolios (excluding inter-bank loans) as of the end of 2019. They comprise around 98% of the total loan portfolio. For some institutions, the information is missing for some years; therefore, the number of observations in econometric models are not multiples of the number of banks.

The data reflect the real state of the Russian banking system, where the top two banks account for more than half of the total loan portfolio. At the same time, as of the

end of 2019, 836 lending institutions were registered and 442 were active [2]. This is also reflected in the descriptive statistics below. However, considering our research topic, we do not find it necessary to exclude any credit institution from the sample. We evaluated the parameters of the equation where *Provision* (the amount of loan loss

provisions in the bank at the end of the year) was accepted as the dependent variable; *LT* (the bank's loan totals at the end of the year) and *Default* (amount of overdue debts in the bank at the end of the year) were taken as the explanatory variables. Descriptive statistics of the variables are shown in Table 1.

Table 1. Descriptive statistics of variables used to build the model, in blns of rubles, using observations 1:1 – 400:6

Variable	Average	Median	S.D.	Min	Max
LT	111.0	3.0	933.0	0.0	19468.5
Default	6.2	0.1	33.8	0.0	604.5
Provision	9.3	0.3	59.1	0.0	1 113.6

Source: authors' own calculations based on ww.banki.ru data.

Table 2. Gross domestic product and loans provided to non-financial organisations and individual customers in Russia from 2011 to 2019

Year	Gross domestic product		Loans to non-financial organisations		Loans to non-financial organisations and individual customers	
	Total value for the year, bln. rubles	Growth rate, %	Total year-end value, bln. rubles	Growth rate, %	Total year-end value, bln. rubles	Growth rate, %
2011	60283		17715		23266	
2012	68164	113.1	19971	112.7	27709	119.1
2013	73134	107.3	22499	112.7	32456	117.1
2014	79030	108.1	29536	131.3	40866	125.9
2015	83087	105.1	33301	112.7	43985	107.6
2016	85616	103.0	30135	90.5	40939	93.1
2017	91843	107.3	30193	100.2	42366	103.5
2018	104335	113.6	33372	110.5	48273	113.9
2019	109362	104.8	33777	101.2	51427	106.5

Source: authors' own calculations based on Bank of Russia data.

These variables proved to be the most relevant. As we tried to increase the number of variables, the estimation quality suffered. At the stage of model selection, apart from simple multiple regression, we considered using a double logarithmic model. However, the model that used simple multiple regression proved to be more efficient.

Thus, in search of an answer to the question “how does the loan loss provision change as the loan portfolio grows, and how can this affect the decision to issue a loan?” we estimate the equation as put forth below:

$$\widehat{Provision}_{it} = \widehat{Const} + \beta_1 \cdot \widehat{LT}_{it} + \beta_2 \cdot \widehat{Default}_{it} \quad (1)$$

The conclusions are formulated with reference to expert community input, and the first-hand experience of the authors.

Results

In the course of this study, we compared annual gross domestic product (GDP) values and total gross loans with maturity dates at the beginning of the coming year provided to non-financial organisations, and (separately) to non-financial organisations and individual customers, and compared their growth rates. The resulting estimates are based on the information provided by the Bank of Russia for the period from 2011 to 2019 [2] (see Table 2).

The results of a correlation analysis have shown a strong connection between the loans to non-financial organisations and GDP (0.88) as well as between GDP and the loans to non-financial organisations and individual customers (0.95). In our opinion, this correlation is quite natural. Consumer lending drives end-user demand; and expanding lending flows to industrial and trade organisations lead to growing production, trade turnover, and

investment and exports, which positively affects GDP trends.

The next step was to compare overdue loans provided to non-financial organisations and the amounts of loan loss provision. A growing gap between the two values is evident. The figures are summarised in Table 3. Coverage ratio shows the relation of loan loss provisions to overdue loans.

Table 3. Overdue loans and loan loss provisions in Russian credit institutions (as in the period from 2010 to 2019)

Date	Overdue loans (OL), bln. Rubles	Loan loss provisions (LLP), bln. rubles	Difference between LLP and OL, bln. rubles	Coverage ratio
01.01.2011	1026	1904	878	1.9
01.01.2012	1114	1988	874	1.8
01.01.2013	1237	2096	859	1.7
01.01.2014	1374	2417	1043	1.8
01.01.2015	1918	3460	1542	1.8
01.01.2016	2940	4526	1586	1.5
01.01.2017	2750	4579	1829	1.7
01.01.2018	2791	5123	2332	1.8
01.01.2019	2854	5407	2553	1.9
01.01.2020	3382	5387	2005	1.6

Source: authors' own calculations based on Bank of Russia data.

Table 4. Financial results and provision charges for credit losses in Russian credit institutions (as in the period from 2010 to 2019)

Year	Financial result (FR), bln. rubles	Provision charges for credit losses (PCCL), bln. rubles	PCCL to FR ratio
2010	573	83	0.1
2011	848	84	0.1
2012	1012	108	0.1
2013	994	321	0.3
2014	589	1043	1.8
2015	192	1066	5.6
2016	930	53	0.1
2017	790	544	0.7
2018	1345	284	0.2
2019	2037	-20	0.0

Source: authors' calculations based on Bank of Russia data.

It was interesting to find out how loan loss provision amounts affect financial results of credit institutions. To that end, by reference to loan loss provision increment, we estimated the banks' expenses that fall under this category (with loan loss provision decreasing, banks' revenue is likely to grow). Then we estimated them against financial results. The estimates have shown a strong negative correlation between these two values (- 0.7). The figures are summarised in Table 4.

Therefore, the estimates show that provision charges for credit losses affect substantially (though indirectly – through profits) the banks' equity trends. We should admit that taking into account growing buffers to risk ratios,

the capacities of earning assets that Russian banks now have at hand, are shrinking. Given H 1.0 capital adequacy ratio is minimum 11.5 % – which is in full compliance with Basel III for TBTF (too-big-to-fail) banks, banks could increase their 100 % risk assets only by 4 trillion rubles. A year ago, this value was as much as 10 trillion rubles. (Authors' estimates based on the figures from The Bank of Russia).

Our next step was to review financial reporting of VTB Bank (Russia), Commerzbank (Germany), and Citigroup Inc. (USA). Our concern was the amounts of overdue loans, loan loss provisions and their ratios evident in the records [37, 38, 39]. The results are shown in Table 5.

Table 5. Some characteristics of loan book quality: VTB bank, Commerzbank, Citigroup Inc as of 01.01.2018

Indicator	VTB Bank, bln. rubles	Commerzbank, mln. Euro	Citigroup Inc, mln. US \$
Loans to non-financial organisations and individual customers	6005	197200	333656
Including Overdue loans (OL)	316	5569	7564
OL as a percentage to total loans, %	5.3	2.8	2.3
Loan loss provision (LLP)	322	781	12355
LLP as a percentage to total loans, %	5.4	0.4	3.7
LLP to OL ratio	1.0	0.1	1.6

Source: authors' own calculations based on banks' annual reports.

We did not include the earlier years since they disclose similar trends and would not add value to the conclusions.

Clearly, credit institutions in developed countries are likely to have lower rates of overdue loans. Among Russian banks, VTB has a lower rate of overdue loans (5.4 %) against Russia's average (6.6%). Moreover, VTB's policy is to keep its loan loss provisions at the lowest possible level. Here, it advantageously stands out against its counterparts throughout Russia. It should be noted that in the Russian banking sector, average loan loss provisions are 1.8 times greater than total overdue loans. By comparison, Citi-

group Inc. reported its loan loss provisions to be 1.6 times greater than its overdue loans. This matches the minimum values that Russian banks have ever reported (in 2015 and 2016, at 1.5 and 1.7 respectively). Alternatively, Commerzbank's loan loss provisions are substantially lower than the totals of its overdue loans.

At the final stage of our research, we built and evaluated a model that enabled to identify the dependence of loan loss provisions on lending and overdue debts. The model was evaluated on panel data using pool regression (the ordinary least squares method) (1), fixed effects model (2), and the random effects model (3) (see Table 6).

Table 6. Models for estimation the impact of lending volumes and overdue debt on loan loss provisions. Dependent variable: *Provision*

	(1) Pooled OLS	(2) Within	(3) GLS
Const	33930 (299600)	86140 (746300)	-188500 (428800)
<i>LT</i>	0.035*** (0.001)	0.028*** (0.006)	0.032*** (0.003)
<i>Default</i>	0.871*** (0.138)	0.983*** (0.146)	0.952*** (0.143)
N	2374	2374	2374
Adjusted R ²	0.955	0.805	

Figures in parentheses refer to robust standard errors *** significant at the 1 percent level.

Source: authors' own calculations based on www.banki.ru data.

As we can see, all the models exhibit similar results, the coefficients of the explanatory variables in all cases being significant at the 1 percent level. Through consistent application of specification tests, we opt for the random effects model. Including dummy values, the time variables did not improve the model; including dummy variables for groups of banks, depending on their size, did not improve the model either.

Thus, we can conclude that a gross loan increase in the range of 1 million rubles leads to the growth of loan loss provisions by 32 thousand rubles. The net interest margin in the banking system of Russia in the first six months of 2019 amounted to 4.3% [40]. A simple calculation reveals that in as long as nine months a bank will begin to profit from the loan; until then, all profit will go to cover provisions. This means that all loans issued after the end of the 1st quarter will be unprofitable for the bank until the end of the year. We believe that this may be a disincentive in terms of granting loans.

Banks have different approaches to loan loss provisioning. The fact that Russian banks lean towards excessively cautious risk-weighting behavior is evident, and this choice seems to be highly unfortunate.

Unreasonable loan loss provisioning is largely due to the attitude and actions of the bank regulator, making risk-weighting estimate on a particular borrower. The regulator can use the information reported by other loan providers, the Bank of Russia's estimates of industry-specific risks, and fair-value and liquidity estimates of mortgaged property. For the time being, credit institutions almost invariably act in compliance with the regulator's requirements. Further, the Bank of Russia does not revise upwards the borrower's financial standing once it has been assigned. This policy should be questioned from a general fiscal perspective, since accumulating excessive provisions leads to the erosion of taxable profits.

We believe that an economically feasible amount of provisions for loan losses should stay at a level comparable with that of actual loan losses. To estimate risk exposure, the value of non-performing loans (NPLs), at 90+ disclosed in banks' financial statements, could be adopted as a benchmark. Keeping loan loss provisions at a level appropriate to real economic parameters, and not overestimated risk exposure, is an urgent challenge for both individual credit institutions in Russia and the industry at large.

An element of indirect evidence to support our view is the fact that the amount of provisions created by Russian banks as of 01.01.2020 under the IFRS is 594.3 billion rubles (11%) less than that under Russian standards. Notably, these results contradict the predictions of many experts, who expected loan loss provisions to grow with the advent of the IFRS.

We believe that in order to reduce labour costs and ensure adequate estimates of loan loss provision, the loan assessment method based on Regulation 590-P should be abandoned, and banks should move fully to the IFRS 9 "Financial Instruments" standard.

Conclusions

We therefore find a negative effect overall in the existing loan loss provisioning procedures and their effect on credit growth in Russia. Reinventing these procedures will spur lending for several reasons.

Firstly, modest loan loss provisioning will allow for a greater percentage of favourable decisions on credit applications. Today, if a potential borrower is deemed to fall within a 'low' category, banks are likely to restrict his access to credit facilities even if there are other indicators in favour of the client. For example, we cannot expect a favourable decision on a loan to be provided at the end of the current quarter if its projected provisions for losses will negatively affect the bank's financial results for the reporting period. In such a case, the client will have to either seek an alternative source of funding, a deferred payment option, or rely on his own resources. At best, the loan provision date will be revised to early next quarter.

Secondly, released funds will improve the financial results of credit institutions and, consequently, will enable them to increase their equity capital. (Note that the increase develops via the a high value factor such as net profit). This will open new opportunities for the banks to build up their loan book. Now, among the crucial factors hindering lending facilities, many bankers list the newly introduced stricter requirements to capital, as well as the requirements to capital adequacy [41].

Thirdly, reduced pressure on financial performance through accumulated provisions may positively influence interest rates on loans by reducing sufficient interest margin and/or risk premiums. From our estimates, the decrease may be as much as 0.5 - 1.0 p.p.

Fourthly, from the taxation side: since the funds for potential loan losses are extracted from banks' taxable profit pools, their reduction would indirectly increase the inflows to the budget due to the greater amounts of tax on profit from credit institutions. This is another advantage of the suggested approach.

Adequate risk assessment is a challenging issue from both the theoretical and practical perspectives. Our focus was on revealing the constraints that hinder bank lending; then we wanted to find out whether there are further opportunities to spur lending activities. We have identified room for improvement in loan loss-provisioning framework. The idea underlying our proposals is to reinvent the existing framework in compliance with actual loan losses. We believe that banks should implement this approach by whatever assessment methods they use. Banks' cautious attitude to qualifying borrowers, largely encouraged by the regulator, leads to lower profit and reduced scope of capital growth, and therefore, creates gaps in credit capacity. Introducing this new framework will indirectly improve (through cost reduction and, consequently, a reduction of interest rate) credit outreach and borrowers' activities.

Within this research, we looked into the pricing mechanism for loans – the interest rate that is influenced by

various factors, such as the cost of funds raised, inflation rate, competition, etc. We focused on the impact of credit risk. Credit risk assessment, in turn, is the bedrock for loan loss provisioning. By downsizing swollen provisions, which fail to reflect the actual risk level, banks open the way to decreasing interest rates and thus increasing their competitiveness. This can be implemented to both base rates and customised lending solutions.

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Green Bonds vs Regular Bonds: Debt Level and Corporate Performance

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Green Bonds vs Regular Bonds: Debt Level and Corporate Performance

Abstract

This paper compares the effectiveness of traditional and green bonds for corporate performance among global companies which issue these types of bonds. Our research represents a first attempt to provide an original empirical contribution with a specific focus on the influence of green debt levels on corporate performance. We develop a framework for the analysis of the influence of the debt level on corporate performance, and also compare the influence of various types of bonds issuance on several indicators of corporate performance.

Our data refer to 118 companies from various industries and countries, including 17 companies issuing green bonds in the period from 2013 to 2017. We study the impact of debt levels on some standard corporate performance indicators, such as ROA, ROE, Revenue/Assets, EBITDA/Assets and EBIT/Assets.

Our results show that bond issuance has a positive effect on corporate performance. In particular, the relationship between debt levels and corporate performance is described in a non-linear way (an inverse U-shape), i.e., as debt level increases, the firm's corporate performance grows, but only up to a certain point where the largest positive effect is achieved. Moreover, we find that the issuance of green bonds has a larger positive impact on corporate efficiency than traditional bonds and the growth in the share of green financing in the total company's debt has a positive impact on corporate performance.

This study opens up avenues for further research in the field, and combining our approach to evaluating the effect of green bonds on corporate performance with an examination of companies arranged according to their life cycle stage would be intriguing. However, at the present stage of development of the green bonds market it is impossible to study their influence on corporate performance as the research selection is rather small, and this market has emerged rather recently.

Key words: green bonds, corporate performance, debt level, multi-regressions

JEL classification: G3, C3, C5, F01, F21, F63 Y1, Y3, Y4

Introduction

The last decade showed several signs of raised awareness in many areas of the financial system of effective mobilisation of capital in green activities. One of the reasons for this is increased global awareness and the interest of executives and investors in preserving the environment and following ESG principles. Green and sustainable finance can play an essential role in reducing carbon emissions, developing resilient climate infrastructure, and improving environmental sustainability, all of which contributes to achieving parts of the UN's sustainable goals for 2030 [1]. Subsequent to 2015, after the signing of the Paris climate agreement, the green bonds market developed rapidly. In 2019, approximately 250 billion US dollars' worth of green bonds were placed. This accounts for 25% of the total global amount of green bonds issued since their first issuance. The most developed green bonds market is in the USA, representing the largest amount of issuances (including the likes of Apple, Amazon, Fannie Mae, etc.). Emerging markets also started indicate investors' concerns vis-à-vis the preservation of the environment through, for example, reductions in carbon emissions. In the Russian emerging market, the first green bonds were issued in 2018 by government-owned companies. Larger private Russian companies may follow their lead.

The objective of this paper is to study the impact of green bond financing on corporate performance. One of the indicators which influences corporate performance is the debt load. Here we will examine both green debt and straight (or regular) debt, in order to ascertain whether green bonds financing has a different impact on corporate performance. Defining the capital structure, including debt financing, plays an essential role in the analysis of corporate sustainable growth. By raising borrowed funds, companies may invest in expansion of production facilities, but by increasing the debt load companies run a heightened bankruptcy risk.

Our paper studies green bonds, which are a new financing method in terms of general Russian practice. Consequently, our work will be also interesting for Russian practice in studying the effectiveness of green bonds on corporate performance. Green bonds may be an effective means for raising loan financing. On one side, the ecological situation in the world requires more serious financing by corporations to preserve the environment. On the other hand, emerging countries grow quicker on account of industrial production, which is detrimental for the global environment. However, in the scientific literature, the amount of work studying a comparison of the influence of straight and green bonds on corporate performance is still limited, and the results obtained so far are controversial.

The novelty of our study is as follows. This research represents a first attempt to provide an original empirical contribution with a specific focus on the influence of green debt levels on corporate performance. We develop a framework for the theoretical aspects of straight bonds and green bonds, analyse approaches for assessment of

the influence of the debt level on corporate performance, and also compare the influence of various types of bonds issuance on several indicators of corporate performance. The purpose of our research is to evaluate whether green bonds have a more positive impact on corporate performance than regular bonds.

This paper is organised as follows. Section 2 describes some characteristics and trends of the green bonds market. In Section 3, we present a review of the relevant literature on capital structure, uncover the principal trends in defining the level of debt load of a company, and consider the factors which influence the level of corporate debt in various economic sectors. We study the governing motives of a change of debt level and analyse the factors which define its size. Section 4 presents the regression models we use to evaluate the influence of the debt level, including green debt, on corporate performance and discusses the methodology of our research. Section 5 analyses the suggested research hypotheses and discusses our empirical results. Finally, Section 6 concludes our study.

The Green Bonds Market: Global Trends

Green bonds are debt securities with the same characteristics as other bonds, whose distinctive feature relates to the fact that the purpose of green bonds is to raise funds to finance projects related to preservation/improvement of the environment. Apart from researchers in the economics of climate change and business practice, PwC (2019) make the point that it is insufficient for a business to only be focused on being profitable and lavish in paying dividends [2]. A business's social and environmental responsibility gains ever-greater significance when evaluating investment attractiveness. The development of the global green bond market is conditioned by understanding and gaining awareness of risks related to the state of the environment, the efforts of businesses (especially larger ones) to be socially responsible, and follow principles related to Environmental Social Governance (ESG).

Thus, the green bonds market continues to develop rapidly. The majority of top companies - industrial leaders (e.g. Apple, Amazon, Saudi Aramco etc.) adhere to ESG principles, and also invest in projects of environment maintenance, and disclose detailed information on sustainable development on official websites.

According to the research by PwC (2019) the capital involved in environmentally responsible investing incremented by one third biennially from 2014 to 2018. Also, out of 2,000 scientific studies conducted since the 1970s, 63% showed a positive correlation between ESG and a higher value of a public company [2]. Those bonds which may be included in the green bonds sector should comply with International Capital Market Association (ICMA) principles, and the green bonds standards of the international non-profit organisation Climate Bonds Initiative (CBI) [3]. These standards provide an extensive

taxonomy and certification for green bonds. Currently, a few EU Member States have labelling schemes in place. These schemes build on different taxonomies and classify environmentally sustainable economic activities. A recent EU taxonomy listed the objectives that green funding should accomplish, being climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems (EU, 2019).

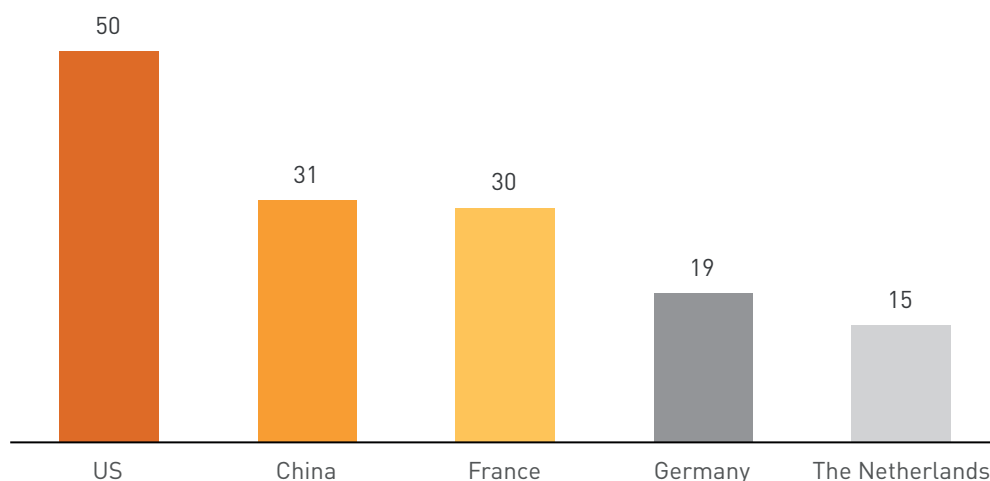
The first green bond was issued in 2007 by the European Investment Bank. The funds gained by placement were used to finance projects of renewable energy and energy efficiency.

Since 2013, a significant growth of the green bonds market has taken place when companies and sovereign borrowers entered the green bonds market. Morgan Stanley named this evolution the 'green bond boom'. According to the Financial Times magazine in March of

2014, Unilever issued green bonds worth of 250 billion pounds in order to reduce waste and gas emissions in their plants. As per The Guardian, in February 2016 Apple issued these kind of bonds, worth 1.25 billion US dollars, in order to finance more power-efficient installations of system heating and cooling and the use of biodegradable materials by the company. In accordance with the data of the non-profit organisation Climate Bonds Initiatives (CBI, 2019) between the years 2007 and 2019 green bonds worth 771 billion US dollars were placed in total, and in 2019 approximately 250 billion US dollars worth were placed [4]. This exceeds by 51% the amount placed within a similar period for the previous year. According to the Bank for International Settlements, in comparison to the general bonds market, green projects amount to 0.6–1.3% of the global market [4].

In Figure 1 the largest countries issuers of green bonds in 2019 are shown. The main issuers of these bonds are the developed economies, such as USA, France, Germany, the Netherlands, and China.

Figure 1. Top 5 countries issuing green bonds in 2019



Source: Capital IQ database, author's own calculations.

As reported by CBI, in 2019 the largest sectors which issued green bonds were the power industry (31% of the green market), construction – 30%, and transport – 20%.

In the American green bonds market the largest issuer is Fannie Mae, involved in mortgage securitisation. In 2019 its share in the total portfolio of green bonds amounted to 9% (22.9 billion US dollars). In Russia, according to the report by the Bank of Russia (2018) the first issue of green bonds was made in December 2018 by Resursos-berezheniye KHMAO LLC (which is a member of a group of companies engaged in solid municipal waste management JSC Upravleniye Otkhodamy) which amounted to 1.1 billion rubles. The second issue was made in May 2019 by RZhD and amounted to 0.5 billion Euro. At the moment, there are no other issues of green bonds in Russia. The Russian green bonds market is just emerging and forms a still meagre share of the global green bonds market.

Debt level and Corporate Performance: a review of the literature

The debt load is directly related to the notion of capital structure. The majority of existing scientific research is based upon the Modigliani-Miller theorem on the independence of capital structure when defining the company value in the circumstances of a perfect capital market, (absent transaction and agency costs).

By using debt financing, the companies obtain advantages which are expressed by the existence of the tax shield (Modigliani – Miller), minimisation of the agency problem between managers and owners [5], and the transfer of positive signals as regards company performance because managers have inside information on the future performance of the company [6]. However, use of debt may also result in the bankruptcy of enterprises. On the other

hand, use of debt may reduce agency costs related to free cash flow, proceeding from the premise that managers tend to observe discipline, take reasonable investment decisions, and not prioritise personal benefits before the interests of the company [7]. The high profitability of a business sends creditors positive signals regarding future cash flows which, in turn, reduces the cost of the debt capital and increases corporate performance. However, in practice, such premises do not always come about. The capital market is not unfaillingly efficient and an economic operator may act unreasonably.

In the next subsections we discuss the literature that dealt with interrelations between debt level, green bonds, and corporate performance.

Influence of Debt Level Including Green Bonds on Corporate Performance

Traditionally, corporate performance has been described in relation to return on assets (ROA). On the one hand, in the paper [8], the interrelation of financial leverage and corporate performance (ROA) was studied using a large selection of Chinese companies. Lev (financial leverage), size (company size), growth and profit (company revenue) were used as independent variables. The paper found that 86% of companies have short-term debt, and the hypothesis of a positive influence of the level of debt load on corporate performance was confirmed. In the paper [9] concerning the influence of debt level on a company's operations, public companies from Ghana were studied. Return on equity (ROE) was used as an indicator of corporate performance, and financial leverage, the revenue logarithm, and revenue growth were used as variables. The empirical analysis found out that corporate performance in the companies where short-term debt prevails is higher than in companies with a significant long-term debt load. Generally, testing also identified a positive relation between the debt load level and corporate performance.

On the other hand, in the paper [10], a non-linear interrelation between the debt load level and efficiency of companies' operation was shown. Debt financing and corporate performance indicators are bound by U-shaped relations to the decisive figure of 56.36%. Consequently, when the debt level is 56%, the corporate performance of a company achieves the largest amount.

So, the debt level, as referred to in the majority of contributions, has a positive impact on corporate performance. Even though a growing number of research papers deal with the issuance of green bonds, there are very few which provide a comparison of green bonds and straight bonds on corporate performance.

New investment terms set a trend among business experts for corporate social responsibility (CSR). It is a method used by companies to comply with the principles of sustainable development. One of the means of implementation of such principles is the issue of green bonds. In the paper [11], three main reasons for issuing these kind

of bonds were distinguished. First, green bonds may be an indicator of the company's commitment to environmental maintenance (known as the *signal argument*). This argument may attract investors because in some cases companies disclose the obligations of environmental care insufficiently when the company has such a concern. Second, a green bonds issue may be a kind of "green advertising of bonds" (greenwashing). Greenwashing represents often unfounded and misleading declarations made by corporate management concerning obligations around environmental preservation. In such cases, companies offer issues of green bonds, describing themselves as ecologically responsible corporations, but they take no actual measures (known as the *greenwashing argument*). Third, companies may issue green bonds in order to obtain a cheaper financing from investors (known as the *cost of capital argument*). Analysis of 565 green bonds issued by 225 companies revealed that the most relevant motive for issue of the new type of bonds, in the opinion of Flammer, is the signal argument in particular. Large cash flows and prospects may be shown through debt increase.

It is argued that this type of green debt funding may be more profitable than equity financing for several reasons, such as:

- Advantages of the tax shield.
- Smaller expenses for raising debt funding than for equity financing.
- Retaining control of the company.
- Less strict regulatory requirements and information disclosure.

It should be noted that research devoted to CSR started long before the corporate management realised the advantages of this approach. For a long time it was thought that investments in environmental preservation initiatives could provide economic benefits only in extraordinary circumstances. However, global companies' strive for reduction of emissions in the environment provides a more stable financial position in the market for such initiatives. Prevention of industrial pollution helps companies to liquidate environment-damaging procedures, readjust manufacturing processes, and cut down the corporate expenses for manufacturing [12]. It is important to notice that the abatement of environmental pollution may increase the demand for ecologically-responsive customers for certain related goods [13–15]. As shown in the paper [16], liquidity in the green bonds market is higher than in the straight bonds market. This confers an advantage to issuers in raising large funds. Usually the investors' demand exceeds supply and green bonds are traded with a negative premium to straight bonds [17; 18].

However, M. Jensen [5] and I. Strebulaev [19] have a contrary opinion as regards the influence of debt level on corporate performance. Their papers show that the relation between debt and companies' profitability is more complex and may be negative. For example, when the debt load increases during periods of hostile takeovers (or during periods of defending against them) a company incurs

huge agency costs. In these cases, the financial leverage is so large that a company cannot operate in its conventional form and earn profit.

S.C. Myers and N.S. Majluf [20] developed a pecking order theory, according to which undistributed profit (categorically known as an 'internal' source) prevails among the financing sources, followed by debt capital, and convertible bonds are the remaining source. Additional issue of shares is used as a last resort, because the market considers it as a negative signal. In accordance with the research [21], expenses for issue of debt obligations in US markets amounted to approximately 1% of the sum of raised funds, while similar expenses related to the issue of shares were in the range of 4 to 15%. From the standpoint of the trade-off approach which implements that companies of a certain industry have similar capital structures, it remains unclear why companies with high profitability tend to choose a lower debt level. From the point of view of the pecking order theory, expenses of an adverse selection of investment projects may outbalance benefits, and therefore companies choose a certain hierarchy of financial instruments. Thus, highly-profitable companies do not need to attract other, less preferable financing sources.

A decision on the amount of debt often depends on the long-term strategy of the company's external borrowings. For example, it is shown in the papers [22; 23] that large companies are financed more from external sources, and in the paper [24] it is indicated that growing companies also raise funds, since they lack proprietary funds and there is a great demand in the capital markets. These studies predict a negative relation between financial leverage and company performance efficiency. In the paper [25], 3,095 companies from Great Britain and the USA were studied in the period 2002–2004. A conclusion was made that business profitability has a negative relation with the possibility of and search for raising external financing. Consequently, in periods of high profitability, companies should use profits to satisfy corporate needs instead of issuing high risk securities.

When companies use debt financing, conflicts of interest between the stakeholders and debtholders may take place, and this results in agency costs. When the financial leverage level is high, managers acting on behalf of their stakeholders may refuse to accept the project with a positive net discounted value because a high-risk debt will replace and absorb a part of the stakeholders' benefits. In such a case, there is also a negative relation between the debt level and corporate performance. In countries with significant government participation in the capital of companies, the negative dynamics of financial leverage and company profitability are observed. In the paper [26] the first empirical research studies of 549 Chinese public companies traded in the Shanghai and Shenzhen stock exchanges were presented. The regression analysis showed that increasing the financial leverage is an ineffective method of cutting agency costs and, consequently, of increasing corporate performance. In the research [9] the interrelation between capital structure and performance

efficiency of companies traded in the Ghana Stock Exchange over the period 1998–2002 was studied. A measure of corporate performance efficiency was ROE (return on equity), and independent variables were debt, revenue, debt/capital and revenue growth %. Analysis revealed a negative relation between a long-term debt and return on equity. It should be noted that the influence of a short-term debt on corporate performance was also studied in this paper. The relation between ROE and short-term debt was strongly positive, moreover, more profitable companies use more often the short-term debt to finance their operations (85% in the total debt amount).

Influence of Green Bonds Issue on Corporate Performance

A few researchers tend to believe that interrelations between the issue of green bonds and corporate performance is positive. S.L. Hart and G. Ahuja [12] found out that a reduction of pollutant emissions within one or two years since the beginning of a project may increase company profits. A.A. King and M.J. Lenox [27] studied 652 US manufacturing companies and rendered a conclusion regarding the positive dependence between environmental care and financial results. C. Lassala, A. Apetrei and J. Sapena [28] noted that there is a positive relation between the financial results of a company and green bonds issue. A selection of 84 companies, which comprised 38 socially responsible companies and 46 companies not involved in social responsibility, was used for their analysis. Their results showed that the return on equity (ROE) of socially responsible companies was higher, especially in the consumer services and technology sector. In the paper by I. Miroshnychenko, R. Barontini and F. Testa [29] the influence of green practice on corporate financial results using ROE and Tobin's Q as a proxy was examined. The selection consisted of 3,490 public companies from 58 countries and 19 economic sectors. Manufacturing (84.9%) and transport (4.5%) accounted for the major part of the total selection. They showed a positive interrelation between the use of green practices, and improvement of financial indicators of a companies' operations.

It should be noted that significant limitations of the above-mentioned results are due to the rather small availability of data, in terms of selecting companies and time lag of implementation of environmental preservation projects.

The authors of this literature display various attitudes towards the efficiency of green bonds. Some of them see a negative influence of green bonds on corporate operations, while others abstain from affirmations concerning the impact of this type of bond on corporate performance. In the paper [30] two selections of companies were tested: 1) companies which issued green bonds; and 2) companies which issued straight bonds. The final selection of companies with green bonds comprised 88 companies, mainly from Great Britain, USA, China, and Japan while the second selection comprised 140 companies. When evaluating the change of the companies' financial status,

ROA was used as a variable and it was discovered that green bonds issuance had no impact on the improvement of companies' financial status. This conclusion may be explained by several reasons. In particular, although at issuance green bonds may potentially improve a company's performance, the market often requires more time for implementation.

Some conventional research studies also think that the ratio of corporate social performance (CSP) to financial performance (FP) is negative. Corporate interests should not be at variance with investors' interests. Achievement of social goals requires additional expenses and contradicts the common goal of profit maximisation. In the article by G. Van der Laan, H. Van Ees, and A. Witteloostuijn [31] the interrelation between social responsibility and financial performance was studied. They made the conclusion that the effect of a negative influence of social indicators on corporate financial performance is much stronger than the CPS's positive contribution to the financial status. For example, when customers' demand is not satisfied due to additional costs for social indicators, the return on assets (ROA) for an average company is reduced from 8 to 0%.

Thus, there are different points of view about the influence of green bonds issue on corporate performance. It should be noted that in recent years the majority of research has served to disentangle indicators of a positive influence. This fact may be conditioned by the development of the green bonds market, and thus of a larger selection of data and studies.

On the basis of the literature we reviewed in Section 3, we present the following research hypotheses.

Hypothesis 1: There is a positive interrelation between issuance of bonds and corporate performance.

Hypothesis 1 is the fundamental one and is based on the assumption that the debt load of companies at the time of bonds issuance is less than the "happy mean" defined by the trade-off theory (otherwise the high probability of default would be included in the expenses of debt servicing). In other words, with such an approach, a company could consider borrowed funds financing as financially unviable. Alternatively, we present:

Hypothesis 2: There is a positive interrelation between debt level and corporate performance.

Moreover, regarding green bonds, we have:

Hypothesis 3: Green bonds issuance has a more positive effect on corporate performance than straight bonds.

Hypothesis 3.1: The growth of the share of green bonds in the amount of company debt has a positive impact on corporate performance.

Methodology and Database

Our analysis will be focused on some indicators of corporate financial performance for a certain period before and after bonds issuance. In our opinion, the full effect

of bond issuance may be observed in at least two to three years after the bond issuance. This assumption is based on the fact that after a bond issuance, a company spends some time on resources for investments and achievement of the first results. The length of green bonds maturity is rather long and often not smaller than five years. Most likely, the life cycle for the green investment project has the same length.

To account for the time it takes for a full effect on corporate performance, we consider the following variations:

change of the company's financial performance indicators in the period not exceeding one year since the date of green bonds issuance, and after the expiry of two years;

change of the company's financial performance indicators within one year since the date of green bonds issuance, and after the expiry of three years.

In accordance with the hypothesis above, the performance indicators should be higher when a longer period is considered (i.e. three years) because the average length of investment projects in the industries which issue green bonds exceeds two-three years in the majority of cases. However, in this analysis the possibility to study only a three-year period after a bond issuance is limited because the majority of bonds in our sample had been issued recently, and an increase of this window will result in a reduction of data availability. Furthermore, the study of the influence of green bonds issuance on corporate performance indicators is impossible without controlling for the selection of companies which did not issue green bonds within the considered period. Our objective consists in comparing changes of corporate financial performance from two selections:

in the first selection all companies issued green bonds;

in the second selection all companies did not issue green bonds within the considered period.

A statistically significant difference in the change of performance indicators will be indicative of an impact of green bonds issuance on corporate financial performance.

However, it should be noted that other factors also influence corporate financial indicators. Theoretically, failure to take these factors into consideration in the analysis may result in biased results. This is precisely why we will add other indicators which may have some influence on corporate performance.

Regression Model Specification

The basic specification of the regression model used in our research is as follows, as exemplified by Revenue/Assets. Depending on the testing of the performance indicator, the following indicators are also selected: RoA, RoE, EBITDA/Assets, EBIT/Assets.

$$\begin{aligned} & \text{Revenue} / \text{Assets}_{\text{post}} - \text{Revenue} / \text{Assets}_{\text{pre}} = \\ & = \beta_0 + \beta_1 * \text{Log}(\text{Assets}) + \beta_2 * \text{Leverage} + \\ & + \beta_3 * \text{Leverage}^2 + \beta_4 * \text{d}(\text{Leverage}) + e \end{aligned}$$

The independent variables are: assets, describing company size (a modified version uses the asset value logarithm); leverage, as a measure of debt load (which is defined as total debt to market capitalisation); the square of financial leverage, to evaluate possible non-linearities; and the change in leverage.

Change of the value of financial leverage in the period of one year before a bond issuance (or absence of issuance for companies from the control selection) and two or three years subsequent to the date of issuance will also be indicative of the amount of the funds raised where X is a corresponding financial indicator for green bonds, and we are interested in understanding how this should influence corporate financial performance. However, we cannot assert with confidence how a change of the financial leverage should influence the company financial performance because the result depends on the amount of the financial leverage before the issue (lesser or more than the “happy mean” defined by the trade-off theory).

We will use the following specification of regression models 1–5 in order to verify hypothesis 1:

$$X_{post} - X_{pre} = \beta_0 + \beta_1 * \text{Log}(Assets) + \beta_2 * d(Leverage) + \beta_3 * \text{Sector O \& G} + \beta_4 * \text{CountryUSA} + \beta_5 * \text{Bond issue} + e$$

where X – a corresponding financial indicator;

The dummy variable *CountryUSA* was used as the largest country-issuer of green bonds worldwide.

In order to verify hypothesis 2 we add the square of the financial leverage for the following specification of regression models:

$$X_{post} - X_{pre} = \beta_0 + \beta_1 * \text{Log}(Assets) + \beta_2 * d(Leverage) + \beta_3 * \text{Sector O \& G} + \beta_4 * \text{CountryUSA} + \beta_5 * \text{Leverage} + \beta_6 * \text{Leverage sq} + \beta_7 * \text{Bond issue} + e$$

In order to verify hypothesis 3 and 3.1 we use the following specification of regression models 1–5, taking into account green bonds issues:

$$X_{post} - X_{pre} = \beta_0 + \beta_1 * \text{Log}(Assets) + \beta_2 * d(Leverage) + \beta_3 * \text{Sector O \& G} + \beta_4 * \text{CountryUSA} + \beta_5 * \text{Leverage} + \beta_6 * \text{Leverage sq} + \beta_7 * \text{Bond issue} + \beta_8 * \text{Green Bond} + \beta_9 * \text{GB / Debt} + e$$

Here, *Green Bond* is a dummy variable which takes a value of 1 if the issued bond is green and 0 otherwise, while *GB/Debt* is the share of green bonds out of total debt at issuance. *GB/Debt* share change is defined after 2 and 3 years after issuance. Green bonds issuance is getting more popular so the growth of *GB* share in total debt portfolio is also increasing after 2 and 3 years since bonds issues.

Data Selection

Table 1 shows the distribution of our data on 118 companies from various industries and countries including 17 companies issuers of green bonds. The most representative selection is the one for bond issuers from the USA (63% of all studied companies) and Europe (33%). First of all, it is related to a high level of development of capital markets in the above regions. It should be noted that the leaders as regards the amount of green bonds issues are Sweden, Norway, and USA (54% of the total selection).

Table 1. Distribution of the chosen companies issuers of green bonds by countries

Country	#	%	Country	#	%
Sweden	4	24	Italy	1	6
Norway	3	18	India	1	6
USA	2	12	Denmark	1	6
Canada	1	6	Great Britain	1	6
France	1	6	Colombia	1	6
Argentina	1	6			

Source: Capital IQ, author's own calculations.

Table 2. Descriptive statistics of the main financial data of companies, in billions of US dollars (unless indicated otherwise)

	Assets	Revenue	EBITDA	EBIT	Financial leverage, %
Min	0.0	0.0	-2.0	-12.5	0
Median	18.2	7.8	1.8	1.2	80

	Assets	Revenue	EBITDA	EBIT	Financial leverage, %
Average	62.0	22.4	5.0	3.5	131
Max	1,893.8	433.5	82.5	71.2	2,811
	RoA	RoE	Revenue/ Assets	EBITDA/ Assets	EBIT/ Assets
Min	-82.5	-99.0	0.0	-46.0	-47.1
Median	3.2	9.6	40.3	9.1	5.7
Average	3.1	10.8	47.6	10.7	6.9
Max	79.4	301.0	199.0	168.1	50.6

Source: Capital IQ, author's own calculations.

It should also be noted that approximately 50% of all considered companies are from extractive or manufacturing sectors of economy, both of which have a significant pernicious effect on the environment. Besides this, the majority of green bonds included in the selection (approximately 65%) were issued by companies from these economic sectors, and this supports the hypothesis on companies' commitment to environmental preservation. Such descriptive statistics of the main financial data collected from companies' reports are indicated in Tables 2–3. It should be also noted that the average financial leverage of the companies in the selection is 131%. It is indicative of such companies' inclination to finance their activity more using borrowed funds, rather than their stakeholders' funds.

Descriptive Statistics of the Chosen Companies

Let us consider in detail the descriptive statistics of corporate performance indicators. The following financial indicators are characteristic of an average company from the selection: RoA amounts to 3.1%; RoE to 10.8%. This means that such company needs approximately nine or ten years to fully achieve the full cost of recovery of invested funds, provided the net profit dynamics within the above period is steady. Moreover, one can make the conclusion on the basis of the data below that the net profit margin of an average company within the period of 2011 to 2019 varied in the range of 6–7%.

A study of descriptive statistics of financial indicators, without taking into consideration the time factor, may result in a loss of some additional information, namely, the nature of the dynamics of indicators between 2011–2019. Appendix 1 illustrates distribution of performance indicators' values from 2008 to 2019. Green marks in the diagram show average values by years, and purple and red marks show maximum and minimum values, respectively. One important conclusion is the relative stability of average values of almost all performance indicators. RoA and RoE are the exception. A special feature of their dynamics is the achievement of maximum values in 2009–2010 and 2018–2019.

On the contrary, in the period of 2015–2017, RoA and RoE values achieved their local minimum. A study of the dynamics of EBIT/Assets made on the basis of use of profit before taxes and interest paid for loans is indicative of an absence of strongly pronounced trends in dynamics, unlike with RoA and RoE. The difference in dynamics may be explained by changes in tax policy in the USA after Donald Trump was elected president in 2016 (tax remissions for corporations were implemented in 2017–2019), and by the interest rate reduction by the US Federal Reserve.

From the point of view of academic research, data concerning bonds issue are of primary interest. The total number of issues made by the companies we analyse in the period of 2013 to 2017 is 323, where 50 issues are green bonds.

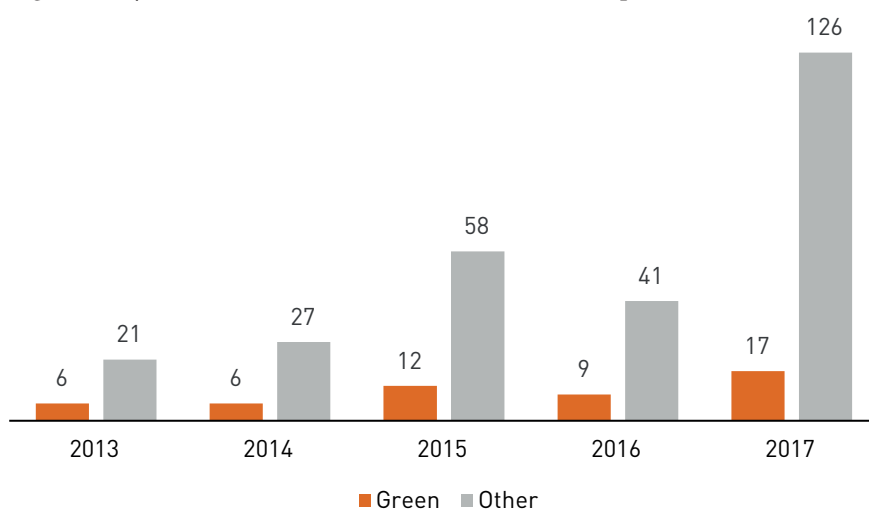
Table 3. Descriptive statistics of the issued bonds characteristics

Green bonds	Sum, million US dollars	Maturity period, years	Option adjusted spread, bpts
Min	3.0	2.0	21.5
Median	120.0	5.0	74.4
Average	339.0	5.9	107.8
Max	2,000.0	15.0	347.5

Green bonds	Sum, million US dollars	Maturity period, years	Option adjusted spread, bpts
Straight bonds	Sum, million US dollars	Maturity period, years	Option adjusted spread, bpts
Min	0.1	3.0	10.9
Median	700.0	10.0	163.2
Average	843.0	10.8	226.1
Max	4,000.0	61.0	2,390.0

Source: Capital IQ, author's own calculations.

Figure 2. Dynamics of the number of bonds issues in the period of 2013 to 2017 by type



Source: Capital IQ, author's own calculations.

Table 3 states the descriptive statistics of the main characteristics of bonds issues. The fact that the average size of green bonds is significantly smaller than that of straight bonds – 339 million US dollars versus 843 million US dollars – is of interest. It should also be noted that the average maturity period of green bonds is virtually half that of straight bonds. This fact may support the hypothesis that companies use green bonds issues to finance investment projects with a lesser payback period and project implementation period.

It is also important that the average spread of green bonds yield to government bonds yield (OAS spread) is significantly less (by 120 basis points) than that of straight bonds. This implies that on average, investors evaluate the degree of credit risk for green bonds as smaller than for straight bonds (Figure 3).

Meanwhile, this result may be related to the fact that green bonds are issued by the companies with a rather high credit rating, and this impacts respectively the yield to maturity, (YTM). In order to verify both hypotheses it is necessary to conduct additional studies.

Speaking of the dynamics of the number of bonds issues, similar trends of both types are worth noting. Moreover, the virtually unchanged share of green bonds issues by years should be mentioned. This fact may be related to our selection of companies.

Results of the Empirical Analysis

Let us discuss the results of the regression analysis. In order to verify each hypothesis we considered five regression models. Let us start from hypothesis 1.

Results of verification of hypothesis 1

Table 4. Verification of hypothesis 1 (one year before bonds issuance – two years after bonds issuance). Robust standard errors were used.

One year “before” – two years “after”	Revenue/ Assets	EBITDA/ Assets	EBIT/ Assets	RoA	RoE
Intercept	0.022	0.19**	-0.033	0.22***	-0.21*
Log(assets)	-0.0071*	-0.021***	0.0007	-0.018***	0.017*
∂ (Leverage)	-0.0007*	-0.0005*	-0.0001	0.0001*	-0.0017***
Sector O&G	0.021*	0.019*	0.015	0.009*	-0.005
Country USA	-0.003	0.001	0.002	-0.005	-0.006*
Bond issue	0.046*	0.065***	0.038*	-0.041	0.14*
Adjusted R sq	0.39	0.48	0.28	0.42	0.49

Signif. Codes: 0.1 (.) 0.05 (*) 0.01 (**) 0.001 (***).

Source: Capital IQ, author’s own calculations.

Table 5. Verification of hypothesis 1 (one year before bonds issuance – three years after bonds issuance). Robust standard errors were used

One year “before” – two years “after”	Revenue/ Assets	EBITDA/ Assets	EBIT/ Assets	RoA	RoE
Intercept	0.0062	0.22***	0.22***	-0.14***	-0.041
Log(assets)	-0.011*	-0.019***	-0.026***	-0.018***	-0.0027
∂ (Leverage)	-0.0005**	-0.0003	-0.0004	-0.0006	-0.0004
Sector O&G	0.023*	0.018*	0.017	0.011*	-0.0027
Country USA	-0.006	0.003	0.001	-0.004	-0.003
Bond issue	0.056**	0.084***	0.076**	-0.0031	0.192***
Adjusted R sq	0.42	0.53	0.50	0.34	0.46

Signif. Codes: 0.1 (.) 0.05 (*) 0.01 (**) 0.001 (***).

Source: Capital IQ, author’s own calculations.

In Table 4, a change of performance indicators is studied for the period of one year before bonds issue and two years after the issue, in Table 5 – the period of one year before bonds issue and three years after the issue.

A study of two different periods described in Tables 6–7 helps not only to evaluate the influence of a bond issue on corporate performance, but also to define the dynamics of such influence: e.g. in how many years after a bond issue the peak effect is achieved.

In accordance with the achieved result, the bond issue has a statistically significant influence on almost all indicators of corporate performance both after two years and after three

years since the date of a bond issue. All other things being equal, the positive effect of a bond issue influences EBIT-DA/Assets in three years by 26% more than its effect after two years. For example, all other things being equal, if a company issues bonds, EBITDA/Assets increases by 8 basis points in three years after the issue. However, it should be noted that the positive influence peak falls at the third year after the issue. This result may be related to the fact that the majority of investment projects have a long period of implementation. As such, the company may achieve the use of new capacities in full, accompanied by a corresponding growth of corporate performance indicators by the end of

the period of the project implementation. Consequently, we do not reject hypothesis 1. It is worth emphasising that the explanatory power of the models with the use of new performance indicators which we have described before is significantly greater than that of models 4 (RoA) and 5 (RoE) in which the return on assets and return on equity are the dependent variables, respectively.

Results of verification of hypothesis 2

As expected, a greater amount of corporate assets is associated with a lower value of the corporate perfor-

mance indicator (it is observed in all models). Meanwhile the statistical significance of change of the corporate financial leverage was not found in almost all modifications of regression models when $n = 3$.

However, when $n = 2$ the statistical significance is observed for models 1 (Revenue/Assets), 2 (EBITDA/Assets), 4 (RoA), 5 (RoE), nevertheless, the signs of evaluation of coefficients are different. Consequently, one cannot assert for sure the directionality of influence of the change of financial leverage on company performance.

Table 6. Verification of hypothesis 2 (one year before bonds issuance – two years after bonds issuance). Robust standard errors were used

One year “before” – two years “after”	Revenue/ Assets	EBITDA/ Assets	EBIT/ Assets	RoA	RoE
Intercept	0.005	0.16***	-0.024	0.11***	-0.28*
Log(assets)	-0.002	-0.012***	-0.001	-0.014***	0.011
Leverage	-0.0008*	0.0005*	0.0007	0.0005	0.004*
Leverage sq	3*e-06	-6*e-07*	-2*e-07	-4*e-07*	-4*e-06*
∂ (Leverage)	-0.0004*	-0.0005	-0.0011	-0.0003	-0.004***
Sector O&G	0.019*	0.015*	0.013	0.01*	-0.003
Country USA	-0.007	0.001	0.005	-0.008	0.003
Bond issue	0.045**	0.064**	0.035*	-0.028	0.12*
Adjusted R sq	0.36	0.49	0.24	0.48	0.55

Signif. Codes: 0.1 (.) 0.05 (*) 0.01 (**) 0.001 (***).

Source: Capital IQ, author's own calculations.

Table 7. Verification of hypothesis 2 (one year before bonds issuance – three years after bonds issuance). Robust standard errors were used

One year “before” – two years “after”	Revenue/ Assets	EBITDA/ Assets	EBIT/ Assets	RoA	RoE
Intercept	0.013	0.21***	0.24***	-0.14***	-0.023
Log(assets)	-0.004*	-0.03***	-0.05***	-0.006***	0.043
Leverage	-0.0003	0.0004*	0.0004*	0.0003*	0.006***
Leverage sq	3*e-06	-1*e-06**	-3*e-06**	-6*e-07*	-3*e-06***
∂ (Leverage)	-0.0005**	0.00011	0.0003	-0.001	-0.007*
Sector O&G	0.005	0.018**	0.011	0.013*	-0.007
Country USA	-0.001	0.005*	0.006	-0.003	0.003
Bond issue	0.069	0.076*	0.079**	-0.061	0.29***
Adjusted R sq	0.32	0.53	0.48	0.36	0.44

Signif. Codes: 0.1 (.) 0.05 (*) 0.01 (**) 0.001 (***).

Source: Capital IQ, author's own calculations.

The results of testing hypothesis 2 are illustrated in Tables 6 and 7. The methodology of its verification is similar to the methodology used for hypothesis 1. In particular, two explicative variables – Leverage and Leverage sq – are added to all models which illustrate the value of the financial leverage at the date of the bond issuance. In our opinion, the influence of financial leverage on the company effectiveness is described by a nonlinear method. As stated above, the trade-off theory contemplates existence of the optimal level of the financial leverage at which the maximum value of corporate performance is achieved. Consequently, in order to take this suggestion into consideration in the analysis, it is necessary to add the value of the square of the financial leverage as the explanatory variable in all regression models.

According to the test results, with both n values the coefficients of the regressors Leverage and Leverage sq are significant. For example, the growth of the financial leverage value by 1 percentage point results in a growth of EBITDA/Assets by 0.6 percentage points in three years after the bond issue. Thus, the influence of the financial leverage value on corporate performance is nonlinear. The coefficient of the regressor of Leverage sq has the negative sign in all forms of regression models, and besides for the explanatory variable Leverage, it is positive. Consequently, it is indicative of the form of dependence of the corporate performance value on the financial leverage value in the form of an inverse parabola. This supports the trade-off theory, although hypothesis 2 is rejected because the relation between the indicators is nonlinear.

Table 8. Verification of hypothesis 3 (one year before bonds issuance – two years after bonds issuance). Robust standard errors were used

One year “before” – two years “after”	Revenue/ Assets	EBITDA/ Assets	EBIT/ Assets	RoA	RoE
Intercept	-0.006	0.18***	-0.025	0.13***	-0.16
Log(assets)	-0.003	-0.026***	-0.0021	-0.015***	0.016
Leverage	-0.0006*	0.0002	0.0004	0.0002	0.0005*
Leverage sq	2*e-06*	-8*e-07	-3*e-07	-3*e-07*	-4*e-06*
∂ (Leverage)	-0.0004*	-0.0003	-0.0001	-0.0002	-0.007***
Sector O&G	0.007	0.021**	0.013	0.017*	0.004
Country USA	-0.003	0.002	0.005	-0.006	-0.002
Bond issue	0.042*	0.068***	0.049*	-0.022***	0.16*
Green bond	0.037*	0.56***	-0.025	0.05*	0.33**
GB/Debt	0.002	0.003*	0.0017*	0.0013*	0.0006
Adjusted R sq	0.38	0.47	0.29	0.48	0.49

Signif. Codes: 0.1 (.) 0.05 (*) 0.01 (**) 0.001 (***).

Source: Capital IQ, author's own calculations.

Results of verification of hypothesis 3

Finally, to verify hypothesis 3 we also added the dummy variable – Green bond – in the model which takes on a value of 1 if the issued bond is green and 0 otherwise.

In accordance with the obtained results of the regression analysis (Tables 8 and 9) the influence of the Green bond indicator on company effectiveness is significant at both values of n (1 or 2). In particular, when green bonds are issued, EBITDA/Assets value grows by 7.3 basis points within three years after the issue. However, the economic significance is higher for $n = 2$. It is

indicative of the fact that at earlier stages following a green bond issue, the positive effect on corporate performance is greater. This result may be related to the fact that investment projects financed from the funds raised from green bonds issue have a relatively shorter investment period. Our conclusion is that hypothesis 3 is not rejected.

The evaluation of the coefficient of the regressor GB/Debt which designates the share of green bonds in the corporate debt level is statistically significant and has a positive sign. In other words, all other things being equal, when the share of green bonds increases by 10%, the performance indicators grow between 1 and 3 basic points. This may be explained by lower rates for such type of borrowings in comparison to other debt instruments. Consequently, hypothesis 3.1 is not rejected.

Table 9. Verification of hypothesis 3 (one year before bonds issuance – three years after bonds issuance). Robust standard errors were used

One year “before” – two years “after”	Revenue/ Assets	EBITDA/ Assets	EBIT/ Assets	RoA	RoE
Intercept	0.012	0.22***	0.21***	0.14***	-0.039
Log(assets)	-0.006*	-0.029***	-0.037***	-0.012***	0.018
Leverage	-0.0003	0.0002*	0.0003*	0.0003*	0.007**
Leverage sq	3*e-06*	-4*e-06	-7*e-06	-3*e-07	-3*e-06***
∂ (Leverage)	-0.0004**	0.0006*	0.0004	-0.0004	-0.0016*
Sector O&G	0.008	0.025*	0.015*	0.012	0.007
Country USA	-0.004	0.0018	0.002*	-0.002	-0.001
Bond issue	0.062**	0.071**	0.075**	-0.001	0.25***
Green bond	0.22	0.37*	0.35*	-0.08	0.11*
GB/Debt	0.005	0.0031*	0.0029*	0.0021*	0.003
Adjusted R sq	0.37	0.51	0.49	0.43	0.45

Signif. Codes: 0.1 (.) 0.05 (*) 0.01 (**) 0.001 (***).

Source: Capital IQ, author's own calculations.

Conclusion

In this article, we evaluated the influence of the debt level on corporate performance in various economic sectors where both green bonds and regular bonds were issued. We can make the following conclusions.

Hypothesis 1: Bonds issuance has a positive effect on corporate performance.

The bond issuance shows a positive influence on almost all corporate performance indicators both after two years and after three years following the date of the bond issuance. The positive effect of the bond issue for EBITDA/Assets is greater after three years than after two years. For example, all other things being equal, if a company issues bonds, EBITDA/Assets increases by 8 basic points in three years after the issue. The positive influence peak falls at the third year after the issue. This is related to the fact that, as a rule, bonds issues show their effect over the long term, sometimes in three years or more. Thus, in longer periods the corporate performance seems to increase.

Hypothesis 2: The interrelation between the debt level and corporate performance is described by means of a **nonlinear** function.

Growth of the financial leverage indicator by 1 percentage point results in a growth of EBITDA/Assets by 0.6 percentage points in three years after the bond issue. Consequently, when the debt level grows, the corporate performance increases by 0.6% in the time horizon of three years. The coefficient of the regressor of Leverage sq has the negative sign in all forms of regression models, and except for the explanatory variable Leverage it is positive. Consequently, it is indicative of the form of dependence of the corporate performance indicator on the financial leverage value in the form of an inverse parabola.

Hypothesis 3: Issuance of green bonds has a **greater positive effect** on corporate performance than the issuance of straight bonds.

When green bonds are issued, EBITDA/Assets value grows by 7.3 basis points in three years after the bond issue. However, the economic significance is higher for a two-year period after the issue of a green bond. It is indicative of the fact that at earlier stages after a green bond issue, the positive effect on corporate performance is greater because green bonds produce effects in a shorter term than straight bonds.

Hypothesis 3.1: Growth of the share of green bonds in the amount of the company debt **has a positive impact** on corporate performance.

All other things being equal, when the share of green bonds increases by 10% the performance indicators grow between 1–3 basis points. We considered several financial performance indicators, where each of them has its advantages and drawbacks. Nevertheless, the choice of specification of the performance indicators has not resulted in significant changes in the research results. It should be noted that performance of the companies which issue bonds, all other things being equal, exceeds performance of the companies which issue straight bonds. One of the most attractive potential lines of future research is to study the influence of green bonds issuance on corporate performance at various life cycles of company development. At the present stage of development of the green bonds market it is impossible to study their influence on corporate performance because the research selection is rather small, and this market has emerged rather recently. For further studies it would be interesting to analyse the influence of green bonds issuance by companies in various countries and economic sectors on their corporate performance.

Appendixes

Appendix 1. Models Testing

Models Testing

Model Revenue/Assets (Table 10)	
Test statistics	Evaluation
H_0 : errors homoscedasticity	
White test	42.74
P-value	0.00
Conclusion	H_0 is not rejected
Breusch-Pagan test	
P-value	7.0557
Conclusion	H_0 is not rejected
H_0 : Absence of errors autocorrelation	
Durbin–Watson test	1.6
Conclusion	H_0 is not rejected
H_0 : Absence of significant multicollinearity	
Mean value of VIF	1.31
Maximum VIF	2.47
Conclusion	H_0 is not rejected
H_0 : The model is adequately specified	
Ramsey test	0.69
P-value	0.50
Conclusion	H_0 is not rejected
H_0 : No endogeneity	
Endogeneity:	$\text{Cov}(\bar{X}_t; \varepsilon_t) = 0$
$\text{Cov}(\bar{X}_t; \varepsilon_t)$	~ 0
Conclusion	H_0 is not rejected

The regression models were verified for adequacy in several stages. At each stage, certain characteristic features of the models were verified, and in case of unsatisfactory results, certain actions were performed in order to improve the quality of the regression models considered in the paper. Below we describe the course of actions performed to verify the models.

The first stage of the verification implies study of characteristics of the remains of regression models for the existence of the heteroscedasticity problem. Among the consequences of existence of this characteristic are inefficient evaluations of coefficients and distortions of prerequisites for the use of t-statistics. In order to check this characteristic feature, we applied two tests: the White test and the Breusch-Pagan test. The zero hypothesis contemplates an absence of the heteroscedasticity problem. If the p-value exceeds a 5% level, the zero hypothesis is rejected, and it is indicative of the presence of the heteroscedasticity problem. In order to solve this problem we used the standard errors justifiable for heteroscedasticity.

The next stage implies verification for errors autocorrelation. In particular, we applied the Durbin-Watson test, the zero hypothesis for which contemplates an absence of errors autocorrelation. The zero hypothesis was not rejected in our models.

At the third stage, we verified the existence of the multicollinearity problem in the data. For this purpose, we used the variance inflation factor (VIF) which was less than 5 for all regressors in the models, and this is an indirect proof of absence of the multicollinearity problem.

We used the Ramsey test to verify the adequacy of the model's specification. The zero hypothesis states that all coefficients preceding regressors equal zero. In a similar way, the zero hypothesis of the Ramsey test is rejected for all models.

In order to solve the endogeneity problem, the instrumental variables method was used when necessary.

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