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Адрес редакции:
Высшая школа экономики,
факультет экономических наук,
Покровский б-р., д. 11, корп. S
Тел.: +7 (495) 621 9192 *27188
E-mail: cf@hse.ru

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Contacts:
Higher School
of Economics (HSE),
11 Pokrovsky Boulevard, Building S
Tel.: +7 (495) 621 9192 *27188
E-mail: cf@hse.ru

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The Impact of Economic Policy Uncertainty on Capital Structure: Evidence from Russia

Brigitte Granville
PhD, Professor
ORCID
E-mail: b.granville@qmul.ac.uk

Queen Mary University of London, London, the United Kingdom

Roman Matousek
ORCID
E-mail: rom.matousek@gmail.com

Queen Mary University of London, London, the United Kingdom

Egor Sokolov
Business Analyst
ORCID
E-mail: sokolovyegor@gmail.com

McKinsey & Company, Moscow, Russia

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The Impact of Economic Policy Uncertainty on Capital Structure: Evidence from Russia

Abstract

This paper is a study of the influence of economic policy uncertainty on the capital structure of companies operating in the Russian market. The sample size is particularly notable (over 16,000 companies and 230,000 observations are included) insofar as previous studies have invariably used smaller selections due to the complexities of data processing. Several hypotheses are proposed and treated which concern the interrelations between company debt policies and the status of individual, sectoral, or industry relevant commercial activity, where the constant threat of economic uncertainty due to political or other external machinations affects the market.

This research paper examines the following capital structure determinants: profitability, asset structure, company size, tax shield, non-debt tax shield, growth opportunity, and risk. The following methods are applied to test a series of nine hypotheses proposed as the most salient indicators of the present state of academic consensus: the Pool model (Pool), the fixed effect model (FE), and the random effect model (RE). In this context, the influence of economic uncertainty on the status of different debt types in 16,882 Russian companies between 2000 and 2017 was studied using the economic policy uncertainty index calculated in 2012.

The results serve to confirm many of the extant hypotheses in the academic literature in the area of capital structural evaluation. For example, it is immediately apparent that the influence of uncertainty is of less significance for large companies as regards all types of debt (joint, short-term and long-term), due to their greater stability and lower risks for creditors. Among other conclusions, it is confirmed that as long as serious government participation is characteristic of the Russian banking system, the efficacy of the debt financing system is not equal for all sectors, and those sectors which are of strategic importance for the state are particularly resilient in troubled economic periods. However, interestingly, in the case of a short-term debt leverage such influence does not materialise.

From a theoretical point of view this paper will be useful for researchers studying the fluctuating market conditions of developing or transitional markets (the large sample size will make this study particularly attractive for further evaluation at all levels of academic analysis). An understanding of the multivariate interrelations described in this paper may also be useful to company managers and investors who will gain insight into the consequences of fluctuations in levels of economic uncertainty for different types of companies.

Keywords: economic policy uncertainty index, capital structure

JEL classification: G23, G28, G32, P34

Introduction

A seminal 1958 paper by Modigliani and Miller [1] initiated an endless dispute about the factors that affect companies' funding decisions. A large number of papers have since investigated and clearly revealed the links that help to understand the role of the factors which define a company's debt load, which include profitability, company size, effective tax rate, company growth, asset tangibility, non-debt tax shield, etc. (see for example [2] and [3]). Nevertheless, the non-specific factors that may affect company debts irrespective of any economic and policy uncertainty only came to attention rather recently [4]; [5].

In terms of analysing the influence of the economic environment on capital structure, the most recent studies ([6]; [7]) include profitability volatility factors in their models as business risks, and have considered inflation uncertainty, interest rates uncertainty, and differences in analytical forecasts as macroeconomic risks. However, even with all these factors considered, the studies have addressed only some aspects of uncertainty.

In this paper, in order to obtain the most comprehensive assessment of the economic uncertainty effect we propose to use the index of economic policy uncertainty proposed by Baker et al. [8]. This index represents the frequency with which articles which discuss economic policy uncertainty are published in mass media. This measure of uncertainty differs from other measures in that it aggregates all possible factors discussed in mass media coverage of economic and political issues, rather than being comprised of separate elements (e.g. uncertainty of inflation, interest rates etc.)

As far as political uncertainty is concerned, essentially, companies perform activities in the business environment which have been defined by national policies, regulations and legislation. Political decisions are taken after several approval stages and implementation of a new policy takes time, which generates political uncertainty in the business environment. This uncertainty may be elevated in cases of disagreement between politicians or government entities. Uncertainty about future events has been seen to influence the behaviour of economic operators [9]; [10].

The research objective of this study is to contribute to current research on economic and policy uncertainty in several ways. First, we investigate the influence of economic policy uncertainty on the capital structure of companies within the Russian market. This includes not only debt, but also the levels and terms of short-term and long-term debt. It is well-recognised that frequent government interventions in market mechanisms are typical properties of emerging and less developed economies (e.g. see [11]; [12]), and the Russian financial market is no exception. One third of the Russian banking system is state-owned. Such a share of the state participation raises the question of whether or not the Russian government influences the direction of funds to certain companies when necessary. This is not a policy limited to Russia, but has been witnessed in many Central and Eastern European countries in the 1990s. By using an extensive data set that includes companies within 'sectors of strategic importance', we intend to investigate the degree to which affiliation with a certain type of activity reduces the influence of uncertainty.

Review of Literature

The majority of research in the field focuses on the study of developed markets of the Western countries and USA [13] [14]. This is logical, as the maturity and diversity of financial markets, good regulation, and the relatively high transparency of activity of companies in developed markets.

Over recent years, emerging markets have been attracting researchers. Questions had been raised as to whether emerging markets were conceptually different in kind to developed ones, had their own specific features, or whether the theoretical concepts used to analyse companies in developed markets may be applied to analyse companies from emerging markets.

On the basis of undertaken research studies [15]; [16]; [17]; [18]; [19]; [20], one may note that emerging markets have certain characteristic properties which influence the companies' financing strategies. Among them are having limited access to capital, high information asymmetry and agency costs, high macroeconomic risks for investors, an ineffective corporate organisation of companies (a large share of state participation, a large share of property owned by one shareholder), and a low level of corporate management.

Thus, the financial markets in emerging countries differ significantly from the markets of developed countries. This results in difficulties in forecasting and long-term planning due to ineffective market functioning and the high risks involved.

At the same, it was proven that the same traditional determinants are generally significant in emerging markets such as profitability, asset structure, company size, and the presence of a tax shield [21]; [22]; [16]; [23]; [24]. However, just as in other research, the direction of influence of some factors on the capital structure may differ depending on the study. This may be due to the fact that not every company can take decisions on the basis of the same mechanism by virtue of their individual characteristics [25].

On account of the market-specific character of companies, some authors put an emphasis on various institutional characteristic properties. For example, the following authors: [21]; [22]; [25]; [26] reveal that state participation in company capital has a positive effect upon the company debt load. This stems from the fact that nearly half of the Russian banking system is state owned, and as a result the banking business represents a political tool for the distribution of financial resources [27]; [28]. Consequently, partly state-owned companies have better access to debt financing in comparison to non-state-owned companies. It has also been pointed out that in the Russian market, companies

tend to have more debts if an oligarch is one of their shareholders [26]. Oligarchs can use their close connections with senior state officials in order to obtain financial assistance by means of credits from state banks [29].

Finally, in emerging markets, a positive impact of the level of development of the banking and legal system and the stock market has been highlighted, alongside a negative impact *vis-á-vis* the levels of corruption.

Initially, when analysing the influence of risks on the capital structure of a company, researchers studied firm-specific risks. L. Fisher [30] showed that the risk premium paid by companies is strongly associated with the levels of volatility exhibited by their profits. N. Baxter [31] writes that changes in company profit levels adversely affect the inclination to receive funding by means of debt. Therefore, companies are inclined to reduce financial distress costs, meaning that companies with relatively volatile potential money flows use less debts in their capital than those with more stable flows. Using the model which considers the bankruptcy costs tax shield, R. Castanias [32] ascertains the inverse relationship between business risk and debt load. He shows that with the existing marginal tax rate and the limiting function of default costs, higher business risks result in a decline of the debt load. M. Bradley et al. [33] consider the model of the capital structure over the same period in order to show the existence of inverse dependence between the optimal debt level and profits volatility.

Thus, the earlier papers considered those factors which are more characteristic of a certain company, instead of external factors which represent the specific character of the environment. Macroeconomic uncertainty was subsequently studied in greater detail. Gertler, Hubbard [34] showed that companies choose joint-stock capital options over debt capital options in periods of increased macroeconomic risk, in order to transfer at least a part of the risks from the creditors. C. Baum [35] demonstrated empirically that an increase in macroeconomic risk factors brings about a significant decrease of the optimal load of a long-term debt. D. Hatzinikolaou et al. [36] found out that uncertainty around inflation has a negative effect on the financial leverage of a company. H. Bhamra et al. [37] and H. Chen [38], using the dynamic capital structure approach, showed that unpredictable changes in macroeconomic conditions have a significant impact on companies' financing policy. In particular, H. Chen [38] predicts that higher macroeconomic risks result in a decrease of the discounted value of the expected tax benefit. As long as the advantages of debt capital diminish, firms seek to reduce its amount when faced with financial hardships. H. Bhamra [37] points out that companies become more conservative (with regard to the use of debt financing) when economics is in an unfavourable state, in order to have financial flexibility. This implies a positive dependence upon financial leverage. M. Caglayan and A. Rashid [39] also show that macroeconomic risk is negatively associated with short-term debt in both public and non-public companies.

One may assume that uncertainty growth is contingent on the slowdown of the GDP growth rate. It should be noted that some papers studied the influence of business cycles on decisions about company financing [40]; [41]; [42]. However, there are serious differences between a business cycle and uncertainty. First, the business cycle and policy uncertainty influence the capital structure conceptually in different ways. The business cycle, in its essence, implies a change in the level of money flows - during boom periods money flows increase, and during recessionary periods they decrease. However, policy uncertainty can influence the debt load more through the demand and supply effect in reference to the debt capital. Although the policy uncertainty and business cycles may be correlated, each relates to different aspects of the economy. The business cycle represents the intensity of business operations and general productivity, while political uncertainty represents the role of the state in the economy's future behaviour [43]. In addition, S. Baker et al. [43] show that political uncertainty may be high not only during periods of economic contraction, but in boom periods as well.

In order to assess economic policy uncertainty, an index of economic policy uncertainty is used which was developed in 2012 by S. Baker et al. [43]. This index was made on the basis of a combination of three types of information: frequency of newspaper articles discussing economic uncertainty and the role of policy, the number of provisions of the federal tax code which were to cease to be effective in the coming years, and the degree of difference of economic forecasts as regards future inflation and future government expenditure for goods and services.

For Russia, the newspaper *Kommersant* is used. This newspaper is published every day all over the country and focuses mainly on economics and politics. In order to define the index, the number of articles which contain the terms "politics", "taxes", "costs", "regulation", "central bank", "law", and terms related to political institutions such as "Duma", "budget", etc. is calculated.

It should be noted that the index based on newspaper texts has a variety of advantages [43]. Other methods of calculating uncertainty (e.g. stock market volatility) are focused strongly on finance and shares while the index based on news represents uncertainty of policy in general, not just the capital market (which affects only public companies). An additional advantage of the news index is the fact that it may be expanded for application in many countries for a long period in the past.

There are two alternative channels [4] through which economic policy uncertainty may influence company financing, which are encompassed by the demand and supply effect. The fundamental idea of the demand and supply effect is that economic policy uncertainty deteriorates the external financing environment. When uncertainty grows, the information asymmetry between borrowers and lenders increases, and at the same time the future cash flows of companies are expected to be more volatile representing a higher risk of default. Both effects may result in higher costs of outside financing, and this,

in turn, induces companies to reduce the debt load in order to obtain a greater financial flexibility. Recent research confirms these ideas. In particular, research focusing on the US financial market has demonstrated that economic policy uncertainty increases the risk premium for municipal bonds [44], incurs additional costs, and imposes more stringent terms on bank credits at the aggregate level as well as at a company level [45]. On the other hand, the demand effect implies the scenario when firms decrease their demand for funding in case of increased economic policy uncertainty. Research has demonstrated that when companies face uncertainty they are inclined to act in a more conservative way when taking investment decisions [46]; [9] and decrease their investments [47]; [48]; [49]. Thus, both channels should result in a negative dependence between economic policy uncertainty and company financial leverage.

At present there are only two empirical studies which consider the influence of economic policy uncertainty on the capital structure. W. Cao et al. [50] analyse 9,283 public and non-public companies in the USA between 1985 and 2011 and obtain a negative dependence between economic policy uncertainty and debt load. At the same time, the influence of uncertainty is lower for public companies. G. Zhang et al. [4], having studied 2,038 public companies in China and in identifying a negative dependent relationship between uncertainty and debt (joint, short-term and long-term debt), demonstrate that this relation is stronger in cases when a company is situated in regions of higher marketisation. Specifically, this was identified as being the case where the company is not partly owned by the government, and where the company has no stable relations with a bank at the time of the uncertainty increase.

This paper extends the existing, yet limited, empirical research of the influence of economic policy uncertainty on capital structure. Further, the scope is not merely extended from the point of view of the whole debt, but from the point of view of short-term and long-term debt separately. Our research differs from existing studies in its large sample size: the selection comprises observations of 16,882 Russian companies in the period covering 2000 to 2015.

The present paper is also interesting from the point of view of understanding how the influence of uncertainty varies with company-specific characteristic properties. First, it is expected that the sample size should mitigate against potential error effects for two reasons: major companies are more diversified and stable [51]; [52]; [53], and the largest Russian companies are very often of systemic national importance. As a result, in hard times the state supports such companies by target debt financing [27]; [16] as long as a considerable part of the banking system in Russia belongs to the state. Second, it is presumed that there are special economic sectors which will also be less exposed to the influence of the environment due to the strategic importance of their activity for the state, which will make the government use the banking system as a political tool to obtain some national goals [27]; [16].

These sectors are indicated in the list contained in 'Federal Law No. 57-FZ On the Procedure of Foreign Investment in Business Entities which are of Strategic Importance for National Defense and State Security', adopted by the State Duma and approved by the Federation Council on April 29, 2008. These sectors are those related to the nuclear power industry, weapons and military equipment, mass media etc.

Hypotheses

After an analysis of the relevant background academic literature, the following hypotheses were generated.

Hypothesis 1. Economic policy uncertainty has an adverse effect on the share of debt in the capital of companies.

Hypothesis 2. The influence of economic policy uncertainty on the share of short-term debt in the capital of major companies is less significant than for companies involved in activities of strategic importance for national defense and state security.

Hypothesis 3. The influence of economic policy uncertainty on the share of long-term debt in the capital of major companies is less significant than for companies involved in activities of strategic importance for national defense and state security.

Data and Methodology

Initially, we obtained data for 60,762 companies operating in Russia in all sectors (except for financial business). Then, the majority of these companies were deleted for the following reasons: 1) some companies were recorded in the database just notionally, they did not publish financial data; 2) many companies had large gaps in their data, e.g. intervals in publication of data of more than three years; 3) anomalous observations were identified and deleted (such values included return on assets results of less than 1 and more than 1, asset tangibility values exceeding 1, results where the ratio of capital expenditure to assets of less than 0 and more than 1.5, and risks values exceeding 1. Consequently 16,882 companies and 232,990 observations were analysed within the model.

The financial indicators of companies were uploaded from the information analysis system BIR-Analytic and the tested variables were calculated on the appropriate basis (see Table 1 below).

Table 1. List of Tested Variables

Variable	Description	Calculation formula
Debttoass	Financial leverage	$\frac{\text{Liabilities}}{\text{Assets}}$
STDebttoass	Short-term financial leverage	$\frac{\text{Short – term liabilities}}{\text{Assets}}$
LTDebttoass	Long-term financial leverage	$\frac{\text{Long – term liabilities}}{\text{Assets}}$
ROA	Profitability	$\frac{\text{Net profit}}{\text{Assets}}$
Tangibility	Asset tangibility	$\frac{\text{Fixed assets}}{\text{Assets}}$
Revenue	Company size	Ln(revenue)
TaxShield	Tax shield	$\frac{\text{Current income tax}}{\text{Income before tax}}$
NDTS	Non-debt tax shield	$\frac{\text{Depreciation}}{\text{Assets}}$
Capextoass	Growth opportunity	$\frac{\text{Capital costs}}{\text{Assets}}$
SDROA	Risks	Standard deviation ROA
EPU	Economic policy uncertainty	Economic Policy Uncertainty Index
Size	Dummy which characterises the company size	0 – small business (revenue up to 400 million rubles), 1 – medium business (revenue from 400 million to 1,000 million rubles), 2 – large business (revenue over 1,000 million rubles)
Important	Dummy which characterises the importance of the sector where the company operates	1 – the company sector is on the list of priority sectors, 0 – the company sector is not on the list of priority sectors

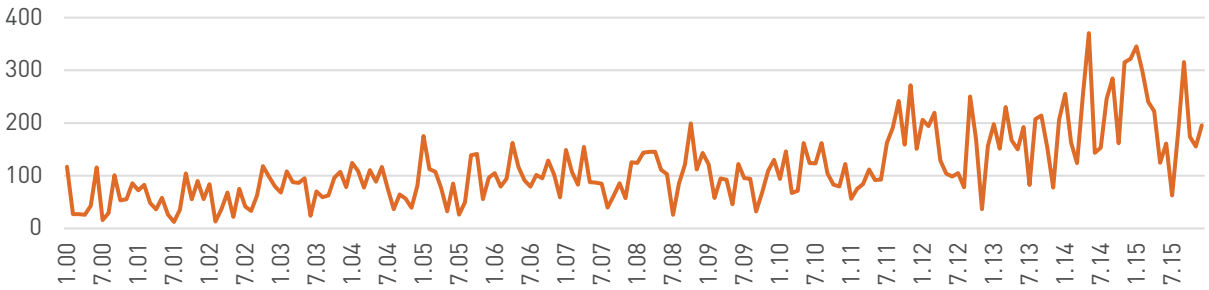
Table 2 presents descriptive statistics of variables used in the model.

Table 2. Descriptive Statistics of Tested Variables

Variable (in the model)	Mean	Standard deviation	Minimum	Median	Maximum
Share of debt in the assets (Debttoass)	0.4655	0.2834	0.00001	0.437131	0.9999
Share of long-term debt in the assets (LTDebttoass)	0.0748	0.1485	0	0.005500	0.9990

Variable (in the model)	Mean	Standard deviation	Minimum	Median	Maximum
Share of short-term debt in the assets (STDebttoass)	0.3907	0.2712	0.00001	0.340107	0.9999
Return on assets (ROA)	0.0853	0.1119	–0.9962	0.0562	0.9993
Asset tangibility (Tangibility)	0.3194	0.2142	5.68e-07	0.2927	0.9924
Revenue (Revenue), thousand rubles	1,646,358	28,200,000	0	144,478	4,330,000,000
Tax shield (TaxShield)	0.2526	0.2234	-0.9960	0.2359	0.9999
Non-debt tax shield (NDTS)	0.0369	0.0315	0.0008	0.0305	0.9510
CapEx/Total Assets (Capextoass)	0.0617	0.0979	1.369e-17	0.0451	1.4801
Risk (SDROA)	0.0776	0.1055	0.0001	0.0502	0.9943
EPU (EPU)	114.9059	50.4323	56.4639	97.4196	232.6986
Dummy-size (Size)	0.4243	0.7285	0	0	2
Dummy-importance (Important)	0.1403	0.3473	0	0	1

Figure 1. Index of economic policy uncertainty in Russia



Source: 'Measuring Economic Policy Uncertainty' by Scott Baker, Nicholas Bloom and Steven J. Davis [43] at www.PolicyUncertainty.com. These data can be used freely with attribution to the authors, the paper, and the website.

Judging by median values, it may be noted that a typical company has a return on assets of about 5.6% and approximately 29.3% of fixed assets, and its revenue amounts to about 145 million rubles, i.e. it is a small company and its activity is of no strategic importance.

As regards the proportion of regions represented in the selection, one may note that traditionally the majority of companies are from Moscow, Moscow Region, and Saint-Petersburg.

As for the economic sectors, it may be noted that the top three as regards the number of companies are the agriculture, construction and food industries. The sector with the biggest number of companies in the selection of the sectors of strategic importance is Machinery and Equipment Manufacture. A large share (7–9%) is also comprised by the following sectors: Metallurgical Production; Production of Vehicles, Trailers and Semitrailers; Extraction of Other Mineral Resources and Extraction of Metallic Ores. Altogether 2,363 companies are considered in the group of sectors of strategic importance.

The values of the economic policy uncertainty index were taken from the website 'http://www.policyuncertainty.com/' which updates monthly information for different countries including Russia. Figure 1 represents the values of the index for 2000–2017. Herewith we shall describe several peaks indicated in the diagram. In March of 2008, Dmitry Medvedev was elected president, in November of 2011 elections for the State Duma were carried out, in December of 2011 protests against violations in those elections took place, and in April of 2014 Crimea was annexed. Mean values for a year will be used in the model.

In consideration of the foregoing, the following models will be used:

Analysis of Influence on the Debt:

$$\begin{aligned}\ln Debttoass_{it} &= \beta_0 + \beta_1 \cdot \ln ROA_{it} + \\ &+ \beta_2 \cdot \ln Tangibility_{it} + \beta_3 \cdot \ln TaxShield_{it} + \\ &+ \beta_4 \cdot \ln NDTS_{it} + \beta_5 \cdot \ln Capextoass_{it} + \\ &+ \beta_6 \cdot \ln SDROA_{it} + \beta_7 \cdot \ln EPU_{it} + \\ &+ \beta_8 \cdot Size \cdot \ln EPU_{it} + \\ &+ \beta_9 \cdot Important \cdot \ln EPU_{it} + \varepsilon_{it}.\end{aligned} \quad (1)$$

Analysis of Influence on a Short-Term Debt:

$$\begin{aligned}\ln STDebttoass_{it} &= \beta_0 + \beta_1 \cdot \ln ROA_{it} + \\ &+ \beta_2 \cdot \ln Tangibility_{it} + \beta_3 \cdot \ln TaxShield_{it} + \\ &+ \beta_4 \cdot \ln NDTS_{it} + \beta_5 \cdot \ln Capextoass_{it} + \\ &+ \beta_6 \cdot \ln SDROA_{it} + \beta_7 \cdot \ln EPU_{it} + \\ &+ \beta_8 \cdot Size \cdot \ln EPU_{it} + \beta_9 \cdot Important \cdot \ln EPU_{it} + \varepsilon_{it}.\end{aligned} \quad (2)$$

Analysis of Influence on a Long-Term Debt:

$$\begin{aligned}\ln LTDebttoass_{it} &= \beta_0 + \beta_1 \cdot \ln ROA_{it} + \\ &+ \beta_2 \cdot \ln Tangibility_{it} + \beta_3 \cdot \ln TaxShield_{it} + \\ &+ \beta_4 \cdot \ln NDTS_{it} + \beta_5 \cdot \ln Capextoass_{it} + \\ &+ \beta_6 \cdot \ln SDROA_{it} + \beta_7 \cdot \ln EPU_{it} + \\ &+ \beta_8 \cdot Size \cdot \ln EPU_{it} + \beta_9 \cdot Important \cdot \ln EPU_{it} + \varepsilon_{it}.\end{aligned} \quad (3)$$

To test the hypotheses we offer to consider three different methods: the Pool model (Pool), the fixed effect model (FE), and the random effect model (RE). In order to choose which model is the optimal one it is necessary to compare each model with each of the other applicable tests. The first test is the F-test which compares the Pool model with the fixed effect model. Using the Breusch–Pagan test we compare the RE-model to the Pool-model. Finally, we have to compare the FE-model to the RE-model. To conclude, we will compare the obtained models using the Hausman test.

Results

Table 3 presents the results of regressions demonstrating the significance level of coefficients.

Table 3. Results of the Pool-, FE- and RE-models

	pool	fe	re
	b	b	b
lnROA	-.1175006***	-.0334549***	-.043996***
lnTangibil~y	- . 2604638***	-. 1456784***	- . 1764622***
lnTaxshield	. 0066822**	- . 0021935	.0024713
lnNDTS	.042661***	- . 0494524***	- . 0256059***
lnCapextoass	. 0725907***	. 0302741***	.0378073***
lnSDROA	- . 0357645***	- . 0324482***	-.0391054***
lnEPU	- . 101093***	-.0751617***	-.0664754***
SizelnEPU	.0248238***	. 0035609***	. 0132428***
Importantl~U	. 01078 61***	.0417109*	. 001 6873
_cons	-1 . 133745***	-1.357252***	-1.229487***

* – 0.05; ** – 0.03; *** – 0.01.

In accordance with the tests (F-test, Breusch–Pagan Test, Hausman Test), results the best suited model is the fixed effect model.

Analysis of Influence on Short-Term Debt

In the analysis procedure we will also consider three models: the *Pool*-model, the *FE*-model, and the *RE*-model. See table 4 for the results of regressions demonstrating the significance levels of coefficients.

Table 4. Results of Pool-, FE- and RE-models

	pool	fe	re
	b	b	b
lnROA	-.0747553***	-.0171764***	- . 0227565***
lnTangibil~y	-.3141624***	-.1474417***	-.2078393***
lnTaxshield	. 1236264***	.0193636***	. 0469793***
lnNDTS	.0822277***	-.0197829***	.0108517**
lnCapextoass	.0627566***	.0233829***	. 0324626***
lnSDROA	-.0308922***	-.0259012***	- . 0322001***
lnEPU	- . 0353115	-.0821978***	- . 0569255***
SizelnEPU	.0159407***	.0064483***	.0136829***
Importantl~U	.0080359***	.0370562	-.0058707
_cons	-1.275815***	-1.369286***	-1.271673***

* – 0.05; ** – 0.03; *** – 0.01.

In accordance with the tests (F-test, Breusch–Pagan Test, Hausman Test), results the best suited model is the fixed effect model.

Interpretation of the Obtained Results

In table 5 one may see the results of building the final regression models for three types of debt. The share of explained variance amounts to 10–14%.

Table 5. Results of the Models for Three Types of Debt

	total	short term	long term
lnROA	- . 0355014***	- . 0171969***	- . 1365615***
lnTangibil~y	- . 1479721***	- . 1474558***	. 3315116***
lnNDTS	-.0439151***	- . 0198276***	- . 0401693**
lnCapextoass	.0315367***	.0233574***	. 0294664***
lnSDROA	- . 02 61268***	- . 0258868***	- . 0511072***
lnEPU	-.0670104***	- . 0508521***	-.0875061*
SizelnEPU	.0038217***	. 0064148***	. 0280613***
Importantl~U	.0405915*		.0162739*
lnTaxshield		.019315***	-.2080167***
_cons	-1.365111***	-1.368992***	-4.393502***
r2_b	. 1023349	. 1303846	.1372527

* – 0.05; ** – 0.03; *** – 0.01.

Out of the three presented hypotheses, only hypothesis 2 was not confirmed. This related to the less significant influence of economic policy uncertainty on the short-term debt leverage for companies of strategic importance.

Each factor is hereby considered individually.

ROA – profitability. The results correspond to the pecking order theory, which holds that if a company has enough internal funds for financing, it will not use debt capital. The obtained relation corresponds to the empirical studies [54]; [55]; [56]; [57], [58].

Tangibility – tangibility of assets. The negative dependence of joint debt and short-term debt corresponds to the pecking order theory which holds that a company owning sufficient tangible assets generates by itself enough money to finance its activity. The other direction of influence on short-term debt confirms the researches of Hall et al. [59]. Yet another direction of influence on long-term debt confirms the studies by both Hall et al. [59] and F. Sogorb-Mira [60] which found out that short-term debt is negatively associated with asset tangibility, and long-term debt is positively associated with it. It may be related to the fact that as a rule long-term debt is used to finance large-scale projects and big capital expenditures, while short-term debt is used for financing short-term assets, and asset tangibility pertains to the share of fixed assets. As long as the companies in the selection have more short-term debt the influence of tangibility on joint debt is the same as on short-term debt.

Taxshield – tax shield. This factor turned out to be significant for long-term and short-term debt, (and what is more, this holds true with different signs), while for joint debt the relation turned out to be insignificant. Absence of a significant coefficient for joint debt is probably related to the fact that the sign of dependence on the tax shield is different for short-term and long-term debt, and as a result this makes the joint debt behaviour ambiguous. The positive dependence of short-term debt and tax shield corresponds to the trade-off theory, which holds that the more the effective tax rate, the more companies borrow in order to create a tax shield. As judged by the results, only short-term debt is used to create the tax shield, probably due to an easier access to such debt. At the same time, long-term debt is a more complex financial product, therefore it is not used for these purposes. The authors who have identified a negative relationship [61]; [62]; [60], in studying small and medium-sized enterprises explain that these enterprises are less profitable, and consequently, more risky. That can bring about a set of circumstances whereby high tax rates result in additional diminishing of profits and a reluctance to borrow. It should be noted that the selection used for analysis in this paper also mainly consists of small and medium-sized enterprises.

NDTS – non-debt tax shield. In accordance with the trade-off theory non-debt tax benefits have a negative effect on debt load, and the results in this study corresponds to the theory. When companies gain non-debt benefits they abnegate the debt-related ones. The obtained relations confirm previous empirical studies, as regards the aggregate capital [54]; [63], and as regards short-term and long-term debts [60].

Capextoass – growth opportunity. The obtained coefficients correspond to the pecking order theory and a number of empirical studies [64]; [65]; [66]; [60]. It means that companies with great growth opportunities tend to get more debt financing to satisfy their needs in terms of growth, i.e. in order to grow more and to use money for capital expenditure it is necessary to have access to sufficient funds.

SDROA – risks. The obtained result corresponds to the pecking order theory and empirical studies [33]; [67]; and [68]. The riskier the company is, the lesser its debt load. This may be due to the fact that creditors are not inclined to jeopardise the safety of repayments of their money.

EPU – economic policy uncertainty. The obtained result corresponds to previous studies [50]; [4]. In periods of uncertainty, companies do not chance taking credits due to the risk of difficulties of repayment, while creditors are not inclined to risk granting loans, thus jeopardising their repayment.

Important*EPU – the influence of companies' activity on the influence of economic policy uncertainty. The positive coefficient (which is opposite to the influence of economic policy uncertainty), may be related to the fact that nearly half of the banking system belongs to the state, which makes banks a political tool, because, if necessary, the state may allocate funds to target sectors for support [27]; [28]. However, such influence was not confirmed for short-term debt, and this is probably related to the fact that state support is mainly provided as long-term debt, thus affecting joint debt as well.

Size*EPU – the effect of a company's size on the influence of economic policy uncertainty. The positive coefficient opposite to the influence of economic policy uncertainty may be related to the fact that large companies are more stable [51]; [52]; [53]. The result is that creditors risk less when financing them by means of debt. As long as the influence of the sector's importance on the influence of uncertainty on short-term debt has not been confirmed it is fair to assume that the influence of size is not related to the support granted to them by the state. Otherwise, if that is the case, the influence on short-term debt for the size and importance would have been the same.

Conclusion

Determinants of capital structure are a key issue in the theory of capital structure. In this paper the influence of traditional factors on the capital structure formation was verified and in general the results of previous studies were confirmed.

Using the index of economic policy uncertainty calculated in 2012, we studied the influence of economic policy uncertainty on the debt load level of 16,882 Russian

companies in the period from 2000 to 2017. The applied uncertainty measure unifies all elements which previously have been tested separately, thus summing up the previous studies concerning the negative influence of uncertainty on debt load. Moreover, it was shown that as long as a significant state participation is characteristic of the Russian banking system, the offer of debt financing is different for various sectors (i.e. the sectors which are of importance for the state are supported in troubled economic periods). However, this influence is nonexistent for the short-term debt leverage. This is probably due to the fact the state supports companies in hard times by means of long-term credits, thus enabling a company to be stable for the near future. The influence of uncertainty is also less significant for major companies as regards all types of debt which, by all appearances, is related to their greater stability and posing less risks for creditors.

An understanding of these interrelations may be useful to company managers and investors who could understand better what will happen to a company when uncertainty in the market increases or decreases. This is particularly true for those operating in fluctuating markets of developing or transitional economies.

At present it is not clear whether the influence of uncertainty on companies of strategic importance is mitigated due to sector-specific character or state participation. In other words, if the majority of companies of a strategically important sector are state-owned, it is the state participation which produces the dominant effect, not the specific character of the sector. Therefore, in future it may be worthwhile to include a dummy variable in the model which is responsible for representing the presence of state ownership in company capital simultaneously with the sectors of strategic importance.

A noteworthy detail in consideration of the process of this study, is that improvement of discipline in Russian companies as regards submitting financial reports could have enabled us to have a larger selection, as well as the fact that an unbalanced panel might have corrupted or displaced the evaluations.

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Corporate Bankruptcy Prediction Using the Principal Components Method

Alexander Grigoriev
PhD, Associate Professor
ORCID
E-mail: a.grigoriev@maastrichtuniversity.nl

Maastricht University, Maastricht, the Netherlands

Konstantin Tarasov
Business Analyst
ORCID
E-mail: knsttrsv@gmail.com

BulletPoint Agency, Moscow, Russia

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Corporate Bankruptcy Prediction Using the Principal Components Method

Abstract

A huge number of articles and papers devoted to the study of bankruptcy prediction problems. Solving the problem of predictive ability many difficulties arise from the processing of data ending with the choice of models and algorithms. Efficiency is formed on the basis of three key aspects, such as tools, data quality and algorithms, formed based on the correct formulation of the problem.

This research raises the problem of predicting the probability of bankruptcy using the method of neural network modeling. The paper proposes an effective prediction algorithm, in comparison with conventional parametric methods and is able to correctly classify on average more than 94% of observations in the sample of Russian small, medium and large businesses. Also during the research, the issue of data processing was touched upon.

By the principal components method of neural networks, factors affecting the bankruptcy and key turning points that could lead to destabilization of the company's normal operations were discovered. Increasing the accuracy of the forecast can be achieved by using more sophisticated algorithms, which are hybrid models.

Keywords: corporate bankruptcy, bankruptcy prediction, profitability, liquidity, principal components method, neural simulation

JEL classification: C38, C53, G33

Introduction

In recent years the Russian economy has been exposed to most complex stress tests, therefore the issue of corporate bankruptcy still appears relevant. It is related to many factors: high risk strategies, currency fluctuations, sanctions imposed by the USA and Western countries in order to destabilize the Russian economy and financial system, geopolitical environment in the Russian Federation. The result is that the Russian economy is subjected to serious fluctuations. In the environment of instability companies are virtually incapable of conducting their business. Sometimes even in a stable economic environment due to wrong strategies or internal problems some companies find themselves in a pre-bankruptcy state. Bankruptcy of large, strategically important industry participants may result in problems not only for directly associated economic agents, but for the economy in general. A proper tool which predicts beforehand critical states and possible bankruptcy of a company may prevent wrong resolutions of management, investors, banks and other creditors. The correct risk assessment related to financial instability of a company may prevent economic downturn in general in case of a crisis.

Warning signs of corporate bankruptcy may be formal and informal. The formal warning sign of an enterprise bankruptcy is its insolvency, that is its inability to fulfill its obligations of making payments to creditors for a long time. The informal warning signs are used mainly in order to improve the prediction accuracy.

The informal warning signs of bankruptcy comprise inefficient performance of financial services and the company information system, sharp changes in statement items, a decrease or steep increase of corporate liquid assets, lack of opportunities for growth and efficient investment, increase of the share of accounts receivable, reduction of material assets, turnover slowdown, debts to employees, shareholders, financial bodies etc.

The present paper is of relevance because it is necessary to improve the bankruptcy prediction mechanism, search for factors which influence the company financial standing. From the scientific point of view this research comprises the idea of increase of the predictive power of the bankruptcy model. But on the practical side it may be applied as one of the versions of an effective methodology. In the article the emphasis is made on small and medium companies because these groups are subjected to financial instability more than large companies. However, large companies also need control over financial stability.

In this research we used neural networks to build the bankruptcy prediction model. The sample multitude consists of Russian small, medium and large companies which conducted business or became bankrupt within 2015–2016 and which fall into the same industry and are of the same size. We use the principal components method as a means of factors dimension reduction and also verify its superiority over the standard model which comprises all considered variables.

The result of the paper will be a positive influence of the offered algorithm on the predictive power of the bankruptcy model as an assessment of Russian companies' standing. The need in improvement of the predictive power is a relevant and unanswered issue because the methods applied in practice are reduced to standard parametric methods with low predictive power.

Literature Review

Corporate Bankruptcy Factors

The interest to bankruptcy prediction arose in the early 1960-ies because cases of destabilization became more frequent. The researchers Beaver [1] and E.I. Altman [2] are considered to be the ground breakers in this sphere.

The possibility to build a bankruptcy model was mentioned for the first time in the research by Beaver [1] who analyzed the indicators of corporate performance as the factors which could predict bankruptcy. In his paper the author considers a selection of 158 American companies from 38 industries which comprises two types of companies: bankrupt and functioning ones, represented in equal proportion. He chose five out of over 30 factors and eliminated all factors which have the smallest influence on the company standing. The research considers three groups of values: non-bankrupts, those which became bankrupt in one or five years.

Altman [2] applied the multiple discriminant analysis method. The selection consisted of 66 companies divided into the companies which became bankrupt in the period of 1946 and 1965, and financially sound ones as of 1966. The author included 22 factors but in the course of the research established that only five indicators were of importance. The result of his research was the Z-score indicator of a considered company. The lower this indicator the less financially sound and more prone to bankruptcy was the company. Altman defined three main groups of values of the Z-score indicator. The companies with the value less than 1.81 fall into the group of potential bankrupts. Altman called the interval of 1.81 to 2.99 an uncertainty range with a high probability of a classification error. The companies with the indicator exceeding 2.99 are considered to be financially sound ones. This method helped to predict the possibility of bankruptcy of approximately 95% of all considered companies.

Nowadays the main emphasis of papers is on improvement of the methodology of bankruptcy models building in order to obtain better predictive models. But one of important aspects is choice of factors which influence the financial standing of a company. The financial indicators such as profitability, liquidity, business activity, capital structure, debt servicing capacity, company size and its growth opportunity are of frequent occurrence in researches. In this article we consider each group of indicators as factors of corporate bankruptcy for small, medium and large companies.

Table 1. Profitability indicators used in the bankruptcy prediction models

Indicator	Indicator explanation	Authors who used the indicators in the bankruptcy prediction models
EBIT/TA	earnings before interest and taxes to total assets	Geng et al., 2015 [10]; Loukeris, Eleftheriadis, 2015 [11]
RETA	retained earning to total assets	Tseng, Hu, 2010 [12]; Ahmadi et al., 2012 [13]; Lee, Choi, 2013 [14]
ROA	return on assets	Bredart, 2014 [15]; Hamdi, Mestiri, 2014 [9]; Tserng et al., 2014 [6]; Geng et al., 2015 [10]; Tudor et al., 2015 [16]
ROE	return on equity	Hamdi, Mestiri, 2014 [9]; Tudor et al., 2015 [16]
ROCE	return on capital employed	Yim, Mitchell, 2005 [8]; Tian et al., 2015 [7]

Table 2. Liquidity indicators used in the bankruptcy prediction models

Indicator	Indicator explanation	Authors who used the indicators in the bankruptcy prediction models
WCTA	working capital to total assets	Alifiah et al., 2013 [19]; Lu et al., 2016 [18]; Tserng et al., 2014 [6]; Loukeris, Eleftheriadis, 2015 [11]
CACL	current assets to current liabilities	Makeeva, Bakurova, 2012 [5]; Bredart, 2014 [15]; Tserng et al., 2014 [6]
ALR	liquid assets to current liabilities	Kasgari et al., 2013 [20]; Geng et al., 2015 [10]; Loukeris & Eleftheriadis, 2015 [11]
TCTA	total cash to current liabilities	Lennox, 1999 [17]; Tseng, Hu, 2010 [12]; Fedorova et al., 2013 [21]
CATA	cash assets to total assets	Fedorova et al., 2013 [21]; Bauer, Agarwal, 2014 [22]
QLR	change in cash to total liabilities	Tseng, Hu, 2010 [12]

Profitability

Profitability is one of the key indicators of corporate performance. The company activity is possible due to a positive amount of profit. Purchase of raw materials and supplies, administration and operating expenses, accounts payable, debt repayment is impossible without a source of funds. In case of lack of funds the company is forced to use borrowed funds which are received by creditors on the basis of the company financial indicators. In case of lack of cashflows or a security to repay the debt the company will be limited in obtaining of borrowed funds. The company profit is the source of its expansion and growth by means of reinvesting funds into companies, development of process-oriented manufacturing, scientific research or investment in profitable projects.

The company profitability has a positive impact on its status. The companies which generate profit are less prone to financial instability as they have an opportunity to mitigate or avoid the influence of instability factors on their activity. This conclusion was first studied in the papers dedicated to developed [2]; [3]; [4]; [5]; [6]; [7] and emerging markets [8]; [9] (table 1).

Liquidity

Liquidity should be understood to mean the ability to pay off debts in short time. The company assets may be divided into highly liquid, low liquid and nonliquid ones, and it implies the speed of sale of an asset at a price close to the market price. The highly liquid assets comprise monetary funds and realizable securities. The low liquid assets are accounts receivable, stock of commodities and materials. Nonliquid assets are buildings, equipment and construction in progress.

The main reason for bankruptcy is the company inability to pay off its debts [12]. An enterprise with liquid assets is subjected to financial instability less than companies with nonliquid assets on the balance sheet. Availability of highly liquid assets helps a company to pay its accounts payable, loans and debts, thus, reducing the likelihood of bankruptcy. It should be noted that a marginally profitable

company predeterminedly has a small amount of highly liquid assets.

The negative relation between corporate assets liquidity and possibility of corporate bankruptcy is confirmed by a range of empiric studies dedicated to advanced countries [2]; [3]; [17]; [5]; [18]; [6]. Researches of emerging markets also confirm this kind of influence [19]; [20] (table 2).

Business Activity

The company business activity affords assessment of efficiency of the corporate assets use. A high turnover of reserves, accounts receivable and accounts payable is characteristic of a company with high business activity and high quality of conducting of business activity, and the speed of such activity is indicative of profitability. Consequently, one can sum up that this indicator influences negatively on the possibility of default (table 3).

Capital structure

Bankruptcy is lack of opportunity to settle with creditors and bank. Such situation may be caused by a large debt. The management has to maintain the financial leverage. A large amount of borrowed funds may result in financial instability and a company will be unable to settle its liabilities, its access to the borrowed funds market will be limited making it impossible to stabilize the financial standing. From this we can deduce that the more well-balanced the financial leverage, the lower the possibility of default [1].

Empiric researches of developed markets confirmed Beaver's [1] assumption of interconnection between the capital structure and possibility of bankruptcy. This confirms a positive effect on the possibility of bankruptcy for emerging markets of Iran [13]; [20] and Brazil [8]. The paper by Ciampi [26] dedicated to prediction of bankruptcy of small, medium and large companies also confirms Beaver's ideas (table 4).

Table 3. Indicators of business activity used in the bankruptcy prediction models

Indicator	indicator explanation	Authors who used the indicators in the bankruptcy prediction models
WCT	work capital turnover	Foreman, 2003 [4]
AT	assets turnover	Altman, 1968 [2]; Odom, Sharda, 1990 [23]; Zhang et al., 1999 [24]; Alifiah et al., 2013 [19]; Hamdi, Mestiri, 2014 [9]
ART	accounts receivable turnover	Lennox, 1999 [17]; Geng et al., 2015 [10]
APT	accounts payable turnover	Tserng et al., 2014 [6]
FAT	fixed assets turnover	Chi, Tang, 2006 [25]; Geng et al., 2015 [10]
IT	inventory turnover	Chi, Tang, 2006 [25]; Geng et al., 2015 [10]
CLT	current liabilities turnover	Fedorova et al., 2013 [21]; Kasgari et al., 2013 [20]
TLT	total liabilities turnover	Fedorova et al., 2013 [21]

Table 4. Indicators of capital structure used in the bankruptcy prediction models

Indicator	Indicator explanation	Authors who used the indicators in the bankruptcy prediction models
TLTA	ratio of total liabilities to total assets	Ohlson, 1980 [3]; Tseng, Hu, 2010 [12]; Kasgari et al., 2013 [20]; Tinoco, Wilson, 2013 [27]; Bauer, Agarwal, 2014 [22]; Geng et al., 2015 [10]; Loukeris, Eleftheriadis, 2015 [11]
TLE	ratio of total liabilities to equity	Chi, Tang, 2006 [25]; Makeeva, Bakurova, 2012 [5]; Fedorova et al., 2013 [21]; Ciampi, 2015 [26]; Geng et al., 2015 [10]
TDTA	ratio of total debt to total assets	Beaver, 1966 [1]; Ahmadi et al., 2012 [13]; Alifiah et al., 2013 [19]; Tserng et al., 2014 [6]; Tian et al., 2015 [7]
TDTL	total debt to total liabilities ratio	Foreman, 2003 [4]
TDE	ratio of total debt to equity	Tudor et al., 2015 [16]

Table 5. Indicators of growth opportunity used in bankruptcy prediction models

Indicator	Indicator explanation	Authors who used the indicators in the bankruptcy prediction models
S_growth	sales growth	Lu et al., 2016 [18]; Tudor et al., 2015 [16]
TA_growth	total assets growth	Serrasqueiro, 2011 [28]; Lee, Choi, 2013 [14]; Tudor et al., 2015 [16]
NI_growth	net income growth	Tudor et al., 2015 [16]

Table 6. Indicators of the company size used in the bankruptcy prediction models

Indicator	Indicator explanation	Authors who used the indicators in the bankruptcy prediction models
LnTa	logarithm of total assets	Chi, Tang, 2006 [25]; Serrasqueiro, 2011 [28]; Lu et al., 2016 [18]; Tudor et al., 2015 [16]
LnS	logarithm of sales	Ohlson, 1980 [3]
Lnemp	company size through employees number	Lennox,1999 [17]

Debt servicing capacity

The ability to pay credit interest is also indicative of financial stability of a company and availability of funds to repay a credit and potential capability of raising additional borrowed funds. As long as the degree of debt servicing is directly related to the company capability to discharge its liabilities this factor has a negative influence on the degree of default.

This was shown in the research by [27] for British companies, as well as for Italian ones [26]. The variable $(EBIT/IntExp)^{-1}$ was used as an indicator of debt servicing.

Growth opportunities

Growth is indicative of the capability to develop and reduce the chance of financial destabilization. A positive effect of growth opportunities on the possibility of bankruptcy was found out for Portuguese small, medium and large companies [28] (table 5).

On the basis of a literature review concerning corporate bankruptcy one may assume that the greatest influence on the possibility of bankruptcy is produced by the indicators of profitability, liquidity and business activity due to frequency of their use in researches. After analysis of the abovementioned articles we will define the main methods and their upgraded approaches which have been offered by the above authors.

Company size

Often in literature the company size is considered as a factor which influences the company size. Small companies are prone to financial destabilization due to limited access to the borrowed funds market. Large companies are more sensitive to high risks which may entail bankruptcy.

Researches dedicated to influence of the company size give no specific answer to the question of influence of the company size on its financial instability. One group of authors considers that as a company grows the possibility of its bankruptcy decreases [3]; [17]; [27], another group points out a positive influence of the company size on the possibility of default [25]; [18]. Serrasqueiro [28] on the basis of a selection of Portuguese companies discovered a positive effect of this indicator on the probability of default (table 6).

Methodology and Data

Principal Components Method

On the basis of a literature review from the point of view of the factors of corporate financial instability 35 variables were chosen (table 1, Appendix B). These factors consist of the indicators of profitability, liquidity, business activity, capital structure, debt servicing, growth opportunities and company size.

In order to reduce dimension of bankruptcy indicators we considered the means of indicators' aggregation. One of the problems of a large number of variables is the danger of network over-training [8]. It is also rather difficult to fetch out of a group of indicators precisely the factors which are most capable of bankruptcy prediction. In view of this in this paper we offer to have recourse to aggregation of input variables my means of the principal components method.

In order to check the assumption of the efficiency of use of the principal components method from the point of view of improvement of the predictive capability of the bankruptcy probability model it is necessary to verify the following hypotheses.

Hypothesis 1. *Aggregation of indicators for prediction of bankruptcy probability of Russian small, medium and large companies using the principal components method has a better effect from the point of view of predictive capability of the model in comparison with use of the variables selected separately from each group of factors.*

The essence of the principal components method consists in reduction of data dimension losing as little information as possible. This method implies redistribution of data in such a way that the considered variables were generalized as relating to a small number of factors (principal components) which record the maximum possible amount of information contained in the source data. This method may also be phrased as a necessity to find factors $z=\left[z_1, z_2, \ldots, z_p\right]$ which represent the linear dependence $u=\left[u_1, u_2, \ldots, u_p\right]$' and initial variables $x=\left[x_1, x_2, \ldots, x_p\right]$ which provide for the maximal variance.

Factor z_1 is a linear combination of initial variables x with the maximal variance. The second component contains the information not included in and not correlated to the first component. The principal components method consists in maximization of variance of the factors $z = xu$, which $u'u=1$, or eigenvalue decomposition of the correlation matrix.

The principal components method is consigned to solution of the following equation:

$$(R-\lambda I)u=0, \quad (1)$$

where R – variables correlation matrix x;

λ – eigenvalue;

u – eigenvector.

Eigenvalues λ are the variance of relevant factors z. The share of the variance of the initial variable x_i corresponding to the first factors represents a sum of squares of factor loadings:

$$\sum_{k=1}^{c} f_{ik}^2 \quad (2)$$

The factor loadings are a correlation of initial variables x

And components z:

$$F=\text{cor}(x,z)=uD^{\frac{1}{2}}, \quad (3)$$

where D – is the diagonal matrix of components' covariants z: $D=\text{diag}(\lambda)$.

The method is used only if there is a correlation between the variables. After transformation z the factors do not correlate to each other. Due to a large number of considered variables it is highly probable that there is a high correlation between the indicators. This encourages application of this method.

Data

The selection of Russian companies was made using the Ruslana database created by Bureau Van Dijk. For the research we analyzed approximately 10 thousand small, medium and large companies which became bankrupt in the period of 2015–2016. The research does not consider earlier periods because financial instability of 2014 resulted in increase of bankruptcy cases in the indicated time. The economic situation in general influences greatly the company standing. Therefore, this period is to be analyzed separately within the issue of influence of political factors on corporate bankruptcy which is an exceptionally interesting issue.

Standards of Ordinance of the Russian Federation Government of July 13, 2015 No. 702 "On Threshold Values of Proceeds of Sales of Goods (Works, Services) for each Category of Small and Medium-Sized Business Entities" were used as criteria of small, medium and large business. In this paper small and medium-sized business is represented by the companies which sales proceeds from goods, works or services net of VAT vary in the range of 150 million roubles to over 2 billion roubles.

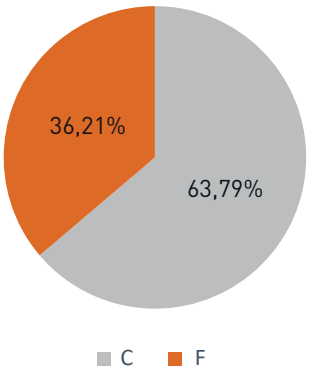
We consider two selections in the paper. The first selection touches upon the industrial sector C which comprises 6,800 companies and the second one also includes the construction sector F and comprises 10,700 companies.

In order to build the bankruptcy probability model, we used the data one year before the bankruptcy had taken place (2015–2016). The result of such model is the company predictive power for one year. We do not build models in this paper two or three years before the bankruptcy because empiric results of the papers dedicated to default probability prediction show a decrease of predictive power with increase of the time horizon between the bankruptcy fact and used data. Thus, a model built on the basis of the data related to one year before the bankruptcy can define potential bankrupts most correctly.

After calculation of the variables necessary for the research and processing of observations with missing values in the selection of bankrupts used for building of the bankruptcy probability model the offered separation and division into stacks method was applied.

Division of companies into industry sectors in accordance with the Russian National Classifier of Types of Economic Activity is presented in fig. 1. The selections consider manufacturing (C – 63.8%) and construction companies (F – 36.21%).

Figure 1. Companies' industry sectoral affiliation



Division of companies in accordance with their status is presented in fig. 2. The selection consists of financially sound companies (1 – 88.80%) and bankrupts (0 – 11.20%).

Figure 2. Companies' status

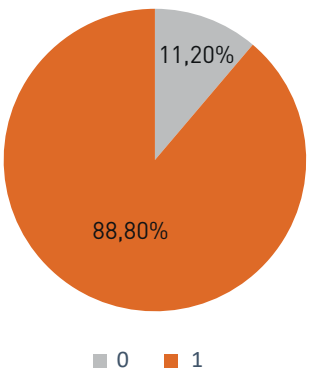


Table 7 comprises descriptive characteristics of variables of manufacturing companies.

Table 7. Descriptive characteristics of variables of manufacturing companies

"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
Bnkrpt_status	6879	1	0	1	6385	0,93	0,003	0,258	0,067
Rev	6879	281292	100	281392	17165287	2495	122	10121	102441791
EBIT/TA_16	6879	84,85	-68,86	15,99	637,78	0,09	0,01	0,92	0,85
EBIT/TA_15	6879	47,75	-1,63	46,12	772,59	0,11	0,01	0,58	0,33
RETA_16	6879	25365,92	-4,42	25361,50	26745,43	3,89	3,69	305,78	93501,85
RETA_15	6879	184,13	-132,50	51,63	1649,41	0,24	0,02	1,79	3,22
ROA_16	6879	4038,01	-1025,61	3012,40	2252,07	0,33	0,46	38,38	1473,40
ROA_15	6879	47,58	-1,93	45,66	396,60	0,06	0,01	0,57	0,33
ROE_16	6879	6368,80	-1864,40	4504,40	9412,62	1,37	0,90	74,36	5529,13
ROE_15	6879	38094,31	-31091,11	7003,20	-36035,52	-5,24	5,22	432,55	187098,14
ROS_16	6879	41,72	-30,07	11,65	69,06	0,01	0,01	0,59	0,34
ROS_15	6879	21,21	-18,11	3,10	78,65	0,01	0,00	0,34	0,12
ROCE_16	6879	5743,93	-108,53	5635,40	10022,03	1,46	0,86	71,67	5135,92
ROCE_15	6879	18180,29	-14319,89	3860,40	-6264,40	-0,91	2,17	180,02	32406,54
WCTA_16	6879	1010,09	-1009,10	0,99	-25,28	0,00	0,15	12,23	149,45
WCTA_15	6879	12,50	-4,83	7,67	1050,90	0,15	0,00	0,38	0,14
CACL_16	6879	184,78	0,00	184,78	17957,42	2,61	0,07	5,50	30,28
CACL_15	6879	245,91	0,02	245,93	16839,69	2,45	0,07	5,62	31,57

"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
ALR_16	6879	159,83	-0,03	159,80	3745,83	0,54	0,04	3,05	9,28
ALR_15	6879	92,39	-0,27	92,12	3405,61	0,50	0,03	2,51	6,30
TCTA_16	6879	0,97	-0,02	0,95	631,65	0,09	0,00	0,13	0,02
TCTA_15	6879	1,17	-0,21	0,96	610,37	0,09	0,00	0,13	0,02
CATA_16	6879	31488,10	0,00	31488,10	59389,29	8,63	5,12	424,53	180229,77
CATA_15	6879	78974,50	0,00	78974,50	244894,81	35,60	17,45	1447,25	2094521,29
QUICK_LR_16	6879	165,64	0,00	165,64	10548,54	1,53	0,05	3,93	15,45
QUICK_LR_15	6879	105,62	0,00	105,62	9690,77	1,41	0,04	3,58	12,80
WCT_16	6879	76355,23	-26856,33	49498,90	197001,70	28,64	11,41	946,15	895207,61
WCT_15	6879	379136,62	-16661,75	362474,87	747099,81	108,61	69,06	5728,01	32810123,67
AT_16	6879	49498,89	0,01	49498,90	75071,98	10,91	7,25	601,54	361845,16
AT_15	6879	1286,05	0,00	1286,05	15091,50	2,19	0,19	15,69	246,05
ART_16	6879	11294,15	0,03	11294,19	100102,50	14,55	1,92	159,61	25476,08
ART_15	6879	12850,79	0,00	12850,79	91358,07	13,29	1,93	159,81	25540,01
APT_16	6879	1808,41	0,00	1808,41	70775,10	10,29	0,43	35,46	1257,51
APT_15	6879	10904,65	0,00	10904,65	79854,89	11,61	1,84	152,73	23327,47
FAT_1_16	6879	91,81	0,00	91,81	2827,27	0,41	0,02	1,66	2,75
FAT_1_15	6879	92,92	0,00	92,92	3019,90	0,44	0,02	1,86	3,48
IT1_1_16	6879	13,64	0,00	13,64	2127,44	0,31	0,01	0,49	0,25

"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
IT1_1_15	6879	29,77	0,00	29,77	2321,99	0,34	0,01	0,75	0,57
IT2_1_16	6879	14,11	0,00	14,11	1694,73	0,25	0,01	0,43	0,18
IT2_1_15	6879	34,33	0,00	34,33	1828,90	0,27	0,01	0,69	0,47
CLT_16	6879	1111,22	0,00	1111,22	49082,07	7,14	0,28	23,07	532,24
CLT_15	6879	10904,65	0,00	10904,65	52619,84	7,65	1,59	131,90	17397,64
TLT_16	6879	1112,16	-0,94	1111,22	39507,11	5,74	0,27	22,29	496,62
TLT_15	6879	10905,84	-1,20	10904,65	42856,98	6,23	1,59	131,67	17336,94
CAT_16	6879	49498,88	0,02	49498,90	85761,90	12,47	7,26	602,11	362541,51
CAT_15	6879	1286,05	0,00	1286,05	22472,32	3,27	0,19	15,84	251,05
ET_16	6879	70414,01	-20915,11	49498,90	369197,77	53,67	11,79	977,67	955833,66
ET_15	6879	173559,15	-119114,13	54445,02	270707,51	39,36	20,83	1727,41	2983940,96
TLTA_16	6879	1012,59	-2,59	1010,00	5844,23	0,85	0,15	12,23	149,63
TLTA_15	6879	7,13	-1,44	5,70	4734,90	0,69	0,00	0,39	0,16
TLE_16	6879	58128,50	-4035,00	54093,50	198408,95	28,84	8,63	715,74	512282,28
TLE_15	6879	291412,08	-184627,25	106784,83	127279,02	18,51	31,50	2612,61	6825714,05
TDTA_16	6879	50,07	-2,70	47,37	1752,67	0,25	0,01	0,72	0,52
TDTA_15	6879	6,53	-1,47	5,07	1740,77	0,25	0,00	0,33	0,11
TDTL_16	6879	1,17	-0,12	1,04	2195,10	0,32	0,00	0,30	0,09
TDTL_15	6879	1,12	-0,10	1,02	2257,29	0,33	0,00	0,31	0,10

"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
TDE_16	6879	9231,82	-787,88	8443,94	45644,01	6,64	1,54	128,03	16391,07
TDE_15	6879	126895,90	-94128,63	32767,28	7763,86	1,13	14,68	1217,29	1481790,88
EBIT_IE_1_16	6879	2500,65	-188,46	2312,18	4781,71	0,70	0,35	28,62	819,02
EBIT_IE_1_15	6879	1376,08	-643,43	732,65	3310,02	0,48	0,18	15,22	231,78
S_GROWTH_16	6879	9267,76	-0,99	9266,77	11330,94	1,65	1,35	111,75	12488,15
S_GROWTH_15	6879	96088,14	-0,99	96087,15	101799,70	14,80	13,97	1158,56	1342256,21
TA_GROWTH_16	6879	31488,10	-1,00	31487,10	54738,09	7,96	5,12	424,53	180224,71
TA_GROWTH_15	6879	78974,46	-0,96	78973,50	197672,21	28,74	16,31	1353,02	1830676,05
NI_GROWTH_16	6879	12313,14	-9785,14	2528,00	-24796,77	-3,61	2,10	173,80	30206,16
NI_GROWTH_15	6879	53363,33	-23806,00	29557,33	24867,59	3,62	6,40	530,70	281640,81
LN_TA_16	6879	17,78	-4,61	13,17	41292,00	6,00	0,02	1,69	2,85
LN_TA_15	6879	17,60	-4,61	12,99	40743,09	5,92	0,02	1,70	2,90
LN_S_16	6879	7,94	4,61	12,55	44076,15	6,41	0,02	1,35	1,83
LN_S_15	6879	16,29	-3,65	12,64	43377,75	6,31	0,02	1,41	2,00
LN_EMP_NUM_16	6879	10,27	0,00	10,27	35114,52	5,11	0,01	1,18	1,40
LN_EMP_NUM_15	6879	9,63	0,69	10,32	34853,15	5,07	0,01	1,23	1,52

Table 8 comprises descriptive characteristics of variables of construction companies.

Table 8. Descriptive characteristics of variables of construction companies

"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
Bnkrpt_status	3905	1	0	1	3191	0,82	0,006	0,387	0,149
Rev	3905	276334	101	276434	4396635	1126	105	6545	42843092
EBIT/TA_16	3905	932,17	-724,98	207,19	-266,87	-0,07	0,21	13,40	179,49
EBIT/TA_15	3905	15,31	-13,00	2,31	186,93	0,05	0,00	0,30	0,09
RETA_16	3905	303,94	-219,84	84,10	412,93	0,11	0,08	5,15	26,56
RETA_15	3905	6206,11	-5,91	6200,20	7797,02	2,00	1,59	99,49	9898,89
ROA_16	3905	436,94	-286,50	150,44	-554,03	-0,14	0,10	6,32	39,92
ROA_15	3905	17,45	-15,17	2,28	80,24	0,02	0,00	0,29	0,09
ROE_16	3905	5163,23	-2559,83	2603,40	3707,34	0,95	1,08	67,54	4561,61
ROE_15	3905	314,50	-76,45	238,05	1862,74	0,48	0,10	6,00	36,02
ROS_16	3905	46,45	-34,06	12,38	-103,85	-0,03	0,01	0,81	0,65
ROS_15	3905	399,21	-385,34	13,87	-426,97	-0,11	0,10	6,20	38,49
ROCE_16	3905	6385,07	-3552,40	2832,67	5865,06	1,50	1,29	80,59	6495,11
ROCE_15	3905	331,36	-84,71	246,64	2956,36	0,76	0,12	7,47	55,84
WCTA_16	3905	1953,83	-1952,83	1,00	-2565,32	-0,66	0,51	32,03	1025,86
WCTA_15	3905	13,08	-12,08	1,00	238,32	0,06	0,01	0,38	0,14
CACL_16	3905	590,85	0,00	590,85	7836,65	2,01	0,20	12,20	148,72

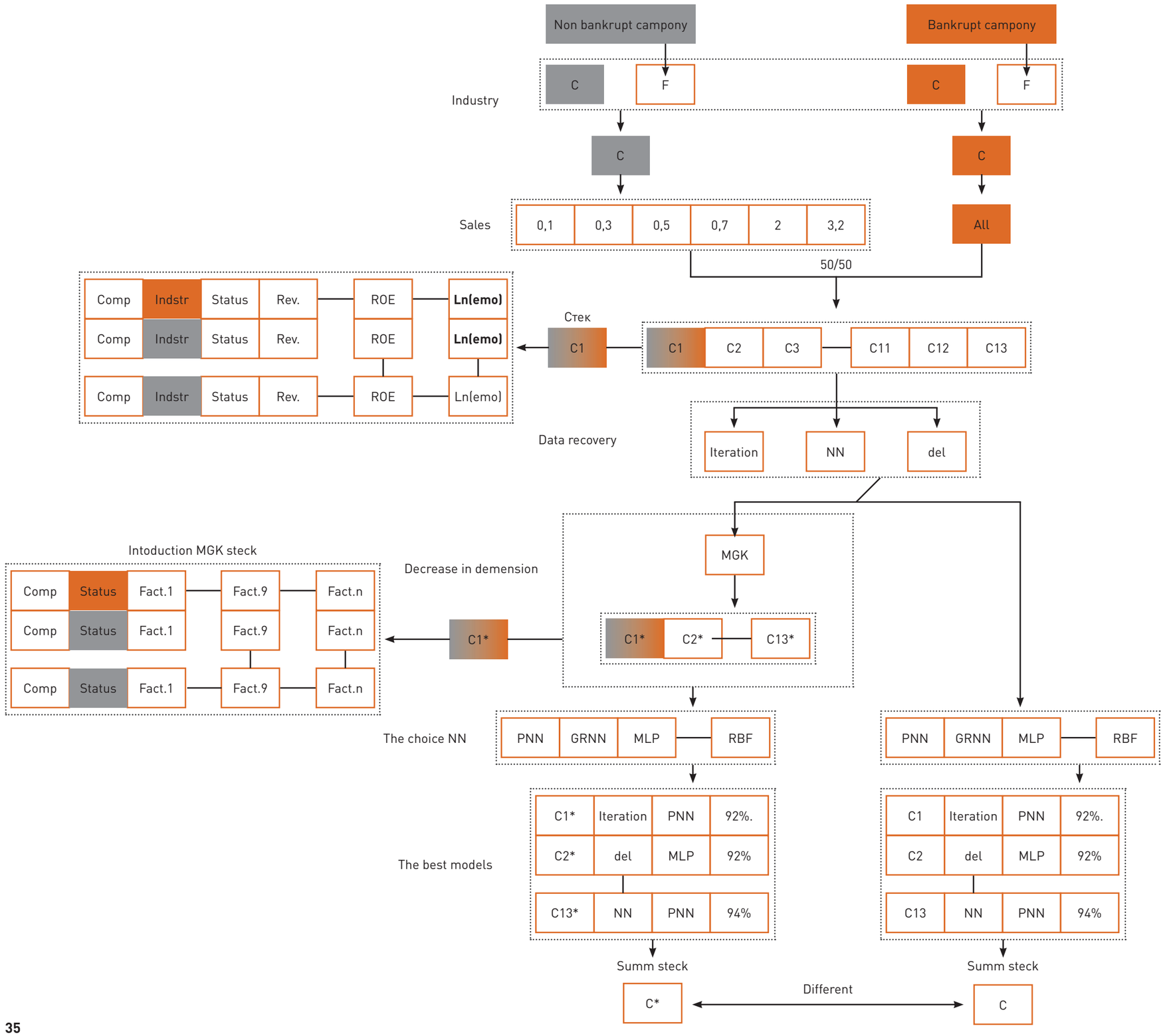
"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
CACL_15	3905	173,06	0,03	173,10	6181,60	1,58	0,06	3,81	14,48
ALR_16	3905	270,85	-0,03	270,82	1757,03	0,45	0,08	4,74	22,43
ALR_15	3905	67,33	0,00	67,33	1334,83	0,34	0,03	1,69	2,85
TCTA_16	3905	1,03	-0,03	1,00	480,68	0,12	0,00	0,16	0,03
TCTA_15	3905	2,04	0,00	2,04	464,64	0,12	0,00	0,16	0,03
CATA_16	3905	45645,70	0,00	45645,70	138762,30	35,53	15,08	942,51	888321,27
CATA_15	3905	51611,39	0,01	51611,40	560891,17	143,67	34,26	2140,66	4582423,26
QUICK_LR_16	3905	590,75	0,00	590,75	5739,67	1,47	0,18	11,23	126,04
QUICK_LR_15	3905	99,03	0,00	99,03	4390,53	1,12	0,04	2,72	7,37
WCT_16	3905	450340,36	-52887,86	397452,50	750194,23	192,16	110,35	6895,08	47542142,07
WCT_15	3905	710494,40	-261773,00	448721,40	397146,32	101,75	133,88	8363,75	69952375,24
AT_16	3905	29577,39	0,01	29577,40	150371,96	38,51	11,88	742,66	551543,96
AT_15	3905	4774,27	0,00	4774,27	16059,57	4,11	1,30	81,22	6596,39
ART_16	3905	12253,13	0,02	12253,14	103559,28	26,55	5,40	337,07	113613,90
ART_15	3905	57274,67	0,00	57274,67	89867,05	23,05	14,73	920,00	846403,66
APT_16	3905	172226,00	0,00	172226,00	289553,11	74,17	45,37	2835,09	8037725,47
APT_15	3905	5404,86	0,00	5404,86	26771,54	6,86	1,52	94,76	8980,13
FAT_1_16	3905	107,08	0,00	107,08	2102,37	0,54	0,06	3,56	12,70
FAT_1_15	3905	16623,44	0,00	16623,44	20681,24	5,30	4,26	266,23	70880,09

"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
IT1_1_16	3905	34,77	0,00	34,77	1463,25	0,37	0,02	1,19	1,41
IT1_1_15	3905	200,89	0,00	200,89	2130,89	0,55	0,06	3,85	14,84
IT2_1_16	3905	23,17	0,00	23,17	1165,12	0,30	0,01	0,89	0,79
IT2_1_15	3905	31,80	0,00	31,80	1416,31	0,36	0,02	1,20	1,45
CLT_16	3905	34404,66	0,00	34404,67	111394,79	28,53	10,33	645,37	416502,02
CLT_15	3905	5404,86	0,00	5404,86	22504,83	5,76	1,49	93,28	8700,84
TLT_16	3905	34404,66	0,00	34404,67	110435,04	28,28	10,33	645,37	416498,03
TLT_15	3905	5404,86	0,00	5404,86	21625,15	5,54	1,49	93,28	8700,35
CAT_16	3905	29577,39	0,01	29577,40	151874,43	38,89	11,88	742,37	551110,43
CAT_15	3905	4774,27	0,00	4774,27	17948,58	4,60	1,30	81,22	6597,42
ET_16	3905	416672,39	-19219,89	397452,50	1280528,63	327,92	111,77	6984,42	48782154,94
ET_15	3905	19341,11	-1362,53	17978,58	417001,71	106,81	10,72	669,57	448327,10
TLTA_16	3905	2007,67	0,00	2007,67	6134,19	1,57	0,53	32,87	1080,68
TLTA_15	3905	13,08	0,00	13,08	3248,30	0,83	0,01	0,40	0,16
TLE_16	3905	183157,22	-25125,72	158031,50	472686,38	121,05	43,41	2712,83	7359458,83
TLE_15	3905	38557,86	-9992,84	28565,02	312434,64	80,01	12,57	785,81	617496,49
TDTA_16	3905	53,88	-0,04	53,83	571,40	0,15	0,01	0,91	0,82
TDTA_15	3905	14,29	-1,21	13,08	516,64	0,13	0,00	0,31	0,10
TDTL_16	3905	1,07	-0,07	1,00	561,61	0,14	0,00	0,22	0,05

"Indicator"	N	Range	Min	Max	Sum	Average		Standard deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Statistics	StdErr	Statistics	Statistics
TDTL_15	3905	3,40	-2,40	1,00	574,81	0,15	0,00	0,23	0,05
TDE_16	3905	21719,42	-3217,78	18501,64	64001,99	16,39	5,99	374,11	139957,89
TDE_15	3905	6625,62	-3764,04	2861,58	18677,47	4,78	1,54	96,30	9272,93
EBIT_IE_1_16	3905	373,36	-219,70	153,66	881,74	0,23	0,09	5,36	28,77
EBIT_IE_1_15	3905	444,77	-337,43	107,34	504,15	0,13	0,12	7,26	52,75
S_GROWTH_16	3905	64062,47	-0,97	64061,50	76399,32	19,56	16,49	1030,45	1061832,00
S_GROWTH_15	3905	4680,32	-1,00	4679,32	22385,91	5,73	1,58	98,73	9747,44
TA_GROWTH_16	3905	45645,70	-1,00	45644,70	135635,24	34,73	15,08	942,53	888359,97
TA_GROWTH_15	3905	51611,36	-0,96	51610,40	560178,40	143,53	34,41	2149,86	4621890,47
NI_GROWTH_16	3905	39956,20	-13973,80	25982,40	-3349,66	-0,86	8,22	513,54	263721,90
NI_GROWTH_15	3905	8073,00	-6872,50	1200,50	-21100,95	-5,41	2,85	178,07	31710,07
LN_TA_16	3905	17,64	-4,96	12,68	22131,47	5,67	0,03	1,67	2,78
LN_TA_15	3905	17,33	-4,96	12,37	21997,10	5,63	0,03	1,71	2,93
LN_S_16	3905	7,92	4,61	12,53	23311,57	5,97	0,02	1,03	1,06
LN_S_15	3905	18,76	-6,21	12,54	22859,50	5,85	0,02	1,28	1,65
LN_EMP_NUM_16	3905	11,39	0,00	11,39	17677,37	4,53	0,02	0,97	0,93
LN_EMP_NUM_15	3905	11,39	0,00	11,39	17460,72	4,47	0,02	1,09	1,19

As we see from table 7 and 8, 35 indicators will be used for calculation. However, it will be somewhat difficult to define the influence of each indicator and for this purpose we will use the principal components method which affords aggregation of indicators and development of the system of indicators' groups which are characteristic of each industry sector.

Figure 3. Algorithm with added aggregation stage and analysis of effectiveness of this method



Separation

The stage of dividing the current revenue company and the formation of primary blocks by revenue

Formation

The stage of adding bankrupts to the formed stacks in different shares

Recovery

At this stage, data recovery occurs. Ultimately, the best recovery method is chosen

Aggregation

The stage of reducing factor dimension by the method of principal components

Education

The stage of choosing the best neural network tool

Creature

The end result is a model consisting of blocks that include stacks of the best models

The Choice

Choosing the best way to predict

Figure 4. Comparative analysis of the predictive power of a forecast as exemplified by the trainable, tested and validation selections for manufacturing sectors

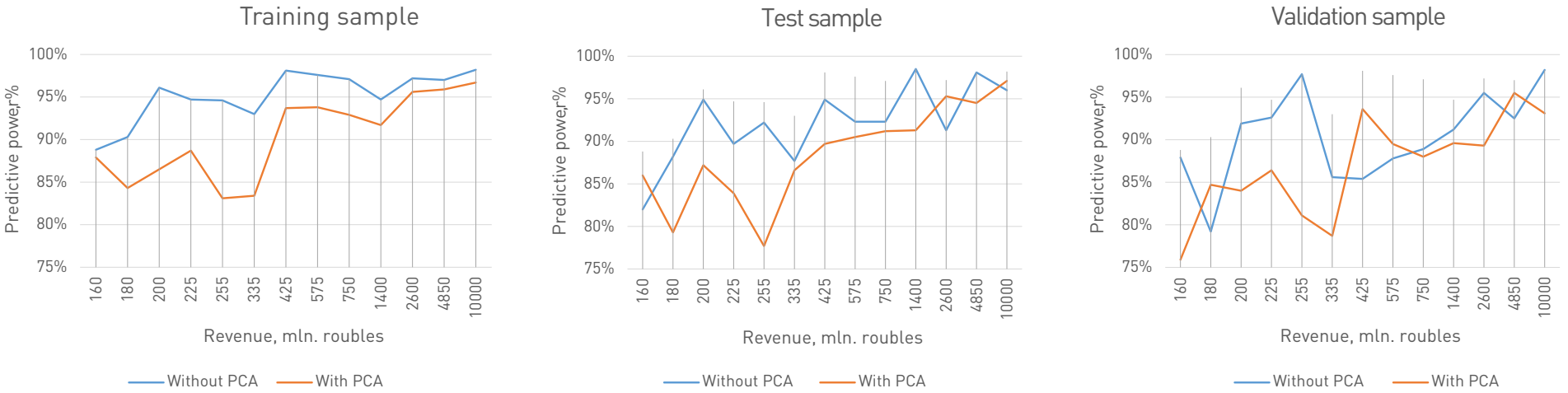
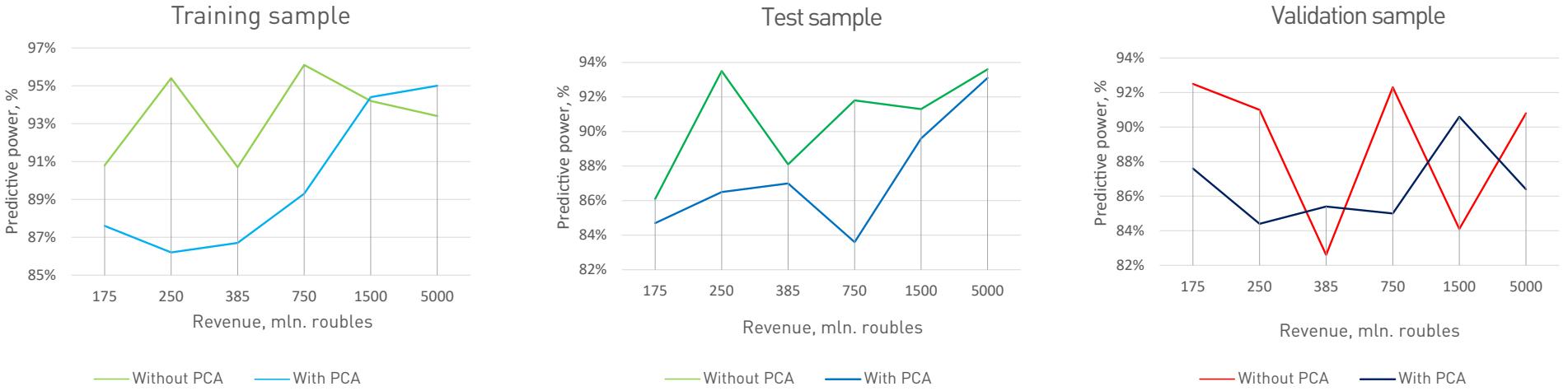


Figure 5. Comparative analysis of the predictive power of a forecast as exemplified by the trainable, tested and validation selections for the construction sector



As we see from fig. 4 for the companies from manufacturing sectors, almost at all stages the principal components method has rather big deviations for 5–15%. This result is typical at virtually all intervals of company sizes, apart from the interval of 425–430 million roubles.

Fig. 5 shows for the companies of the construction sector F a more interesting situation. The principal components method affords smoothing over of sharp outlying data and, thus, during the test of the validation selection there arise outlying data, but this is true only for a small group of validation selections.

Econometric Analysis and its Results

Our selection consists of 1,200 bankrupt companies and 8,700 financially sound companies which totals to 10 thousand companies. We will use the offered method presented in fig. 3 as a forecast and try to define the influence of the method on the predictive power.

After forming the aggregate indicators we started the procedure of prediction and defining the significant factors. Analysis of interconnection between the main components and bankruptcy probability at each stack in the correlation matrix is indicative of a significant influence of two to four main components (at the 20% significance level as an assumption). Therein, the majority of correlation coefficients between the main components are of significance and do not exceed 0.5 in absolute magnitude.

The hypothesis of improvement of the predictive power applying the principal components method is rejected but it has a set of assumptions at which the hypothesis will still be accepted in case of presence in the selection of a large amount of outlying data and relevantly small validation selection.

Conclusion

A large number of articles is dedicated to improvement of quality of bankruptcy prediction. Modern methods in this sphere consist in development of complex composite hybrid models which consist not just of neural networks but of genetic algorithmization. Such models may provide the maximum predictive capability, however, this is an issue for a new research, while the offered method has an opportunity for further improvement of methodology. A high predictive power of the model helps investors, banks and other creditors to foresee potential financial problems of a company with s greater accuracy. Therefore, in this article we study the quality of methodology applied for assessment of business solvency of Russian small, medium and large companies from the point of view of the ability to predict correctly the bankruptcy probability. To do this the separation algorithm was offered.

The forecasting was done using neural simulation. 35 indicators which characterize profitability, liquidity, business activity, capital structure, debt servicing, growth opportunities, company size were used. They were selected on the basis of a literature review and were aggregated applying the principal components method. It was found out that use of the principal components method does not increase the predictive power of a model in comparison to use of the variables selected separately from each group of factors.

The conclusion of this research is that it is necessary to increase accuracy of the forecast of the models which are used in practice for assessment of business solvency of Russian small, medium and large companies. It is possible to improve the methodology by means of applying advanced methodologies accompanied by complicating of models, employment of additional underlying behavioral factor, use of methods of data recovery and hybrid networks.

For further study of this issue it is interesting to consider the problem of accuracy of processing of lost or missing data applying genetic algorithmization and dynamic models.

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Does Smart & Powerful CEO Contribute to the Performance of Technology Companies?

Elena Karnoukhova
Master of Economic Sciences, Researcher
ORCID
E-mail: elena.karnouhova@gmail.com

Corporate Finance Center, National Research University Higher School of Economics, Moscow, Russia

Anastasia Stepanova
PhD, Associate Professor
Research Fellow
ORCID
E-mail: anastasianstepanova@gmail.com

School of Finance, National Research University Higher School of Economics, Moscow, Russia
Corporate Finance Center, National Research University Higher School of Economics, Moscow, Russia

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Does Smart & Powerful CEO Contribute to the Performance of Technology Companies?

Abstract

In recent decades, innovative companies became one of the major drivers of economy worldwide. According to surveys, nearly 70% of the world's most innovative companies in 2019 are U.S. firms. However, academic studies mostly focused on the influence of the top management team and the board of director's on the firm performance, on the relationship between innovations and CEO`s preferences. However, we suppose CEO can exert a significant influence on performance of innovative companies. We strive to show which CEO characteristics could lead to higher firm value. Does highly educated CEO contribute more to innovations in hi-tech sphere? Does CEO power matter? Are founders better CEOs than newcomers or professionals for technological companies with their longer horizons and higher risks? This research uses Generalized Least Square model on a sample of 12565 firm-year observations during 2004-2015 period. For this research we used data for three innovative industries: Pharmaceuticals, Biotechnology & Life Sciences, Software & Services and Technology Hardware & Equipment industries. We have hand-collected data from the CVs in CIQ database. Overall, the empirical results reveal that educational background, tenure, duality play crucial roles in explaining firm value. This study contributes to the existing literature in two aspects. First, our findings indicate that CEO characteristics play crucial roles in explaining technology firm value and performance. We demonstrated that founding CEO contributes to technology firm performance as well as the CEO with better education. Second, CEOs should be smart and powerful in order to sustain firm performance. We found that CEOs characteristics could mitigate the conflicts between different types of investors and their influence on firm performance. More specifically, CEO-founder was found to add greatly to the firm performance of Software and Pharmaceutical companies. Furthermore, the influence of CEO seems to mitigate the conflict of interest with independent active institutional investors in Hardware industry. We provided examples to prove the validity of our tests.

Keywords: CEOs characteristics, innovative companies, ownership structure, firm performance

JEL classification: G32, G41

Introduction

The subsequent logical question is why do we choose to explore an innovative firm? Primary, recent outlooks show that the companies from the sector of innovation technologies became the leaders of the global economy (Apple, Microsoft, Facebook, Amazon), surpassing oil and gas (ExxonMobil, BP) and bank industry (HSBC, JP Morgan Chase). On the other hand, the start–up activity in the technological sector is increasing over time, observing the rise in the Rate of Startup Growth of Kauffman index by 11.5% from 2013. And, according to the UNESCO Institute of Statistics the global R&D spending has reached a peak of almost US$ 1.7 trillion, where the proportion of the USA is 37.9% in 2013, surpassing all other regions. Today, the major part of total spending (70.6%) is in the business sector.

These new market developments create uncertain impacts on the innovative market. New technological firms stand under competition pressure. Thus, firms need to adjust their strategies to the new market demand. This could be delegated not only to the board of directors, but to the CEO. So, it is important to understand which characteristics of the CEO could lead to the value creation in innovative industries.

A large body of literature has researched how top management team and the board of director's influence innovations. Fu (2019) [1] linked corporate innovations and board independence in Chinese companies. The author stands for the positive impact of the short tenure of CEO on firm performance in the context of high competition. High product competition was found to have a large impact on CEO power (Sheikh, 2018 [2]). Behavioral studies in this area are focused on the CEO's motivation to promote innovations. Cho, Kim (2017) [3] show the influence of short career horizon on breakthrough innovations. Even CEO`s hobby of flying airplanes was found to be positively related to the innovation output (Sunder et al. 2017 [4]).

Studies has been mostly focused on the relationship between innovations and CEO`s preferences: e.g. political preferences of CEO (Han, 2019 [5]), CEO research talent (Jung, Subramanian, 2017 [6]), CEO charisma (Zhang, Ou, Wang, 2017 [7]), CEO's creative leadership (Makri, Scandura, 2010 [8]). Thus, little attention has been paid to the investigation of the CEO characteristics themselves. In this article we follow Chen, Lin, Song, Li (2011) [9] study showing how educational and professional background of CEO influences firm's innovation efforts. However, in our study we take a particular look at innovative industries. We strive to show which CEO characteristics could lead to higher firm value. Does highly educated CEO contribute more to innovations in hi-tech sphere? Does CEO power matter? Are founders better CEOs than newcomers or professionals for technological companies with their longer horizons and higher risks? This study seeks to fill these gaps.

The reasons for the fast growth of technological companies are still debatable. Scholars are trying to link their performance to the composition of board of directors, to independent directors, to ownership and capital structures. In this article we try to find out whether the leader's characteristics matter for the value creation in innovative industries. If yes, then which characteristics are more important than others. Recently, Forbes has created a new list of "the most creative and successful business minds of today". They measure four essential leadership qualities of top founders and CEOs, including media reputation for innovation, social connections, track record for value creation and investor expectations for value creation[1], in an attempt to explain who stimulates innovations

These research gave us an impulse to explore different characteristics of CEO in technological companies and their influence on the firm performance of three innovative industries of US market. However, in the academic literature the simultaneous influence of type of owner and CEO characteristics on the firm performance has been neglected. In our previous paper Karnoukhova, Stepanova, Kokoreva (2019) [10] we found that different types of investors differently affect firm performance in innovative industries. So, in this study we make a next step into the understanding of how and by whom the innovations are stimulated. We still believe that different types of investors with their goals and risk preferences matter. However, now we also want to know whether highly educated, committed and powerful CEO influence the performance of companies in innovative industries.

The remainder of this study is organized as follows. Section 1 provides the introduction. Section 2 describes the literature review. The sample selection and empirical model are described in Section 3. Section 4 presents the empirical results. Finally, the conclusions are presented in Section 5.

Literature review

A large body of studies emerge with the appearance of a new group of economy`s drivers – innovative companies. However, little attention has been paid to the investigation of the innovative industry. Most of the articles focus on the relationship between R&D activities and the performance or innovativeness of a firm (Baysinger, Kosnik, Turk, 1991 [11]; Hoskisson et al., 2002 [12]; Cleyn, Braet, 2012 [13]; Rafiq, Salim, Russell, 2016 [14]). The deep-in observation on the ownership type was presented by Hoskisson et al. (2002) [12], suggesting, that insiders tend to internal innovation as public pension funds and outsiders with professional investment funds' managers prefers

[1] Forbes, 2019. WHO ARE THE MOST CREATIVE AND SUCCESSFUL BUSINESS MINDS OF TODAY? https://www.forbes.com/lists/innovative-leaders/#11658f8426aa

to acquire the external innovation. The same results on the relationship between foreign ownership were obtained by Chen, Lin, Lin, Hsiao (2016) [15] and Talaja (2013) [16]. However, for the sample of 138 Taiwanese firms Chen et al., (2016) [15] detect the negative relationship between the ownership concentration and the innovative performance in terms of the number of granted patents. Besides, the authors show that the presence of independent director on board positively influences on innovation strategy of a company. For the sample of 49 SMEs in the Flemish manufacturing industries Cleyn, Braet (2012) [13] show that the size of the board of directors positively impact on the placement of a new innovative product during the last two years. In this paper the authors detect higher debt recourse for the sample of innovative companies, assuming that financial institutions have more faith in the development of these type of firms. By comparing the financial performance of major US and Chinese mining firms Rafiq, Salim, Russell (2016) [14] argue that firm age plays an important role in moderating R&D activities. They found that the maturity firm in both countries is more profitable in terms of sales (7.2%) and profit (4.4%) that its younger non-innovative counterpart.

On the other hand, there is an ongoing debate on the extent to which different characteristics of an innovative firm influence on its performance. Among the major feature researchers mainly distinguish the composition of the board of directors, especially the intellectual capital of innovative firms (Hull, Rothenberg, 2008 [17]; Jiménez-Jiménez, Sanz-Valle, 2011 [18]; Erisson, Qin, Wang, 2015 [19]; Héroux, Fortin, 2016 [20]), ownership structure (Gavious, Hirsh, Kaufman, 2015 [21]; Hsu, Lai, Li, 2016 [22]; Colombo, Croce, Murtinu, 2014 [23]), and industry specifications (Ching, Lieu, Hung, 2016 [24]).

Knowledge is an important source of value creating in innovative companies, that is why both the quality of personnel and corporate practices seem to impact on firm performance. Hull, Rothenberg (2008) [17] note that in low-innovation firms the stronger is the social performance of the company the better is its financial performance. The authors suggest that the moderating of social practices is a time-consuming process, which decreases therefore the management activity towards new product development. Meanwhile, Jiménez-Jiménez, Sanz-Valle (2011) [18] show that the functional diversity and the educational level of the top-management team (TMT) is positively related to innovation, whereas tenure is negatively associated with innovation. The same results were obtained by Héroux, Fortin (2016) [20]. For the sample of 163 S&P/TSX composite index the authors found that the industry background and the competence of managers positively impact on product and process innovation, accordingly. However, the opposite result was demonstrated for the firm size and the diversity of the tenure of the board, which have both positive impact on each type of innovation. A similar attempt has been made by Erisson, Qin, Wang (2015) [19] in using the turnover of technical employee as a measure of HRM practices in innovative companies. For 582 Chinese companies in 5 high-tech industries (energy, electronic information, biotechnology, equipment manufacturing and environmental protection) the authors demonstrate the U-shape relation between the turnover of R&D employees and the innovative performance (in terms of product and process innovation).

Recent articles devoted to the ownership structure of innovative companies distinct almost the equivalent industry classification. Examining 29 high-tech firms belonging to pyramidal groups Gavious, Hirsh, Kaufman (2015) [21] found that biotechnology firms and other high-technology firms have different ownership patterns. So, there is evidence to suggest that this could be a reason of different relationship with similar parameters. The distinction between different effect of owner-manager and individual non-manager owner on the performance of 255 Italian unlisted high-tech entrepreneurial firms was proposed by Colombo, Croce, Murtinu (2014) [23]. The main conclusion is that the higher the number of owner-manager the better is the performance through the reducing of horizontal agency costs. In contrast, for the sample of 1391 public Taiwanese firms from innovative industry Hsu, Lai, Li (2016) [22] connect the increase in foreign institutional, corporate and government ownership in line with high R&D intensity with an upgrade in corporate transparency. Overall, the above contrary results of similar studies suggest the difference between developed and emerging countries. In addition, Ching, Lieu, Hung (2016) [24] for Taiwanese 386 firms across 25 high-tech and service sectors show the dominance of firm specific factors among performance measures.

The geographical particularity was one of the focus of later studies (Knyazeva et al., 2013 [25]; Balsmeiera, Buchwaldc, Stiebale, 2014 [26]; Boasson et al., 2015 [27]). The special study was presented by Balsmeiera, Buchwaldc, Stiebale (2014) [26], which demonstrates that the proximity of outside director significantly and positively influences on the patenting activities of German firms. For pharmaceutical and biotechnological industries, the study conducted on both emerging and developed markets show that insider ownership and scientific connections play an important role on the transaction economies by fostering the R&D intensity, whereas the board independence is negatively related to the R&D intensity on European market (Tereshchenko, Stepanova, 2016 [28]). Finally, further study of biotechnological industry in Korea provides the following conclusion: R&D development are encouraged mostly by foreign linkages and governmental support (Kang, Park, 2012 [29]).

We observe that among all this studies little attention has been paid on the investigation of CEO characteristics (educational level, tenure and gender) of high-tech companies, that could encourage firm performance. Using our results, we will fill this gap in the field of corporate finance. For the future methodology we suggest to control our main hypothesis by R&D intensity of a firm.

Methodology and data

We verify the importance of CEOs characteristics in innovative firms. Nowadays, researchers commonly use the Eurostat and OECD classification of an innovative firms: manufacturing firms (technology intensity of sector) and service provider (knowledge intensity of sector). According to NACE Rev. 1.1 (2002) Knowledge Intensive Firms (KIF) are characterized by its high knowledge, capital intensity and the narrow degree of specialization (real estate activities, financial intermediation, post and telecommunication etc.) and manufacturing firms are divided into high (more than 4% of R&D turnover), medium-high (between 1% and 4% of R&D turnover), medium-low (between 1% and 4% of R&D turnover) and low technology (less than 1% of R&D turnover). In this article we will consider high technology manufacturing firms: manufacturers of pharmaceuticals, medical chemicals and botanic production (22.4), manufacturers of office machinery and computers (30), manufacturers of radio, television and communication equipment and apparatus (32). In our sample we use the data from Bloomberg database, we adopt its classification, which consolidates technological industry, mentioned above. So, we will distinguish three main high-technology industry: Pharmaceuticals, Biotechnology & Life Sciences, Software& Services, and Hardware &Technology Equipment.

Data and descriptive statistics

We obtained the data from Bloomberg and Capital IQ databases. We collected from Bloomberg board characteristics and financial data, including Tobin's, ROE, ROA. From Capital IQ we downloaded the data for all types of investors following their classification by institutional and strategic, including their strategies (active, passive). Moreover, CIQ provides an opportunity to collect the data for the first five major shareholders with the percentage of owned share, name, type and strategy. Firstly, we collected all firms from Russell 3000 index, the most suitable capitalization weighted equity index, which captures approximately 98% of U.S firms. This index is the benchmark widely used in scholar`s studies (Crane et al., 2014 [30]; Appel et al., 2016 [31]). Thus, the first data sample for the period from 2004 to 2015 consists of 26269 firm-year observations for 2957 firms. Then, using the Bloomberg industry classification we extract 24 industry sectors. We choose only 3 from them according to our needs. We extracted 642 technological firms. We classified technological firms as Pharmaceuticals, Biotechnology & Life Sciences (270 members), Software & Services (250 members) and Technology Hardware & Equipment (122 members).

From descriptive statistics in Table 1 in Appendix we observe top five major shareholders of each investor`s group. Top five grey investors with active strategy own 0,4% on average, grey institutions with not active/ passive strategy own 0,5%, independent institutions with active strategy own 8%, independent with not active/passive 2,9%, independent with passive strategy own 4%, strategic owners have 8,7% on average, state own 1% on average. For the whole sample 11% of board belong to women and 77% to independent directors on average. Company age varies from 3 to 145, which means that be exploring Russell 3000 index we investigate full range of firms, from the youngest to the oldest.

We distinguish three high-tech industries in terms of CEO characteristics, especially their knowledge formation. Table 2 in Appendix demonstrates the difference among Pharmaceuticals, Biotechnology & Life Sciences, Software & Services and Technology Hardware & Equipment industries. We review that CEOs in Pharmaceuticals, Biotechnology & Life Sciences have higher educational degree overall, and, with the highest number of PhD degree members. Moreover, CEOs are educated mostly in Natural Science and have Medical Doctor degree. The most part of CEO in Software & Services possesses a Bachelor of Arts degree, and are mostly educated in Computer science. Finally, in Technology Hardware & Equipment industry CEOs are professional in Engineering with a Bachelor of Science degree.

Model specification

We stress the hypothesis that in innovative industries Intellectual Capital is connected with firm value and could have some interference within the effectiveness of institutional investors.

As the first part of additional research we conduct an analysis of the relationship between CEO characteristics and firm performance of innovative companies (Chen, 2014 [32]):

$$\begin{aligned}\text{Performance}_{it} &= \beta_0 + \beta_1 \times \text{Tenure}_{it} + \beta_2 \times \text{Degree}_{it} + \\ &+ \beta_3 \times \text{Founder}_{it} + \beta_4 \times \text{Gender}_{it} + \beta_5 \times \text{Board}_{it} + \\ &+ \beta_6 \times \text{Controls}_{it} + \varepsilon_{it}\end{aligned} \quad (1)$$

As the second part we imply different types of investors in previous model in order to understand whether CEO characteristics alter the relationship between investor`s type and firm performance:

$$\begin{aligned}\text{Performance}_{it} &= \beta_0 + \beta_1 \times \text{Tenure}_{it} + \\ &+ \beta_2 \times \text{Degree}_{it} + \beta_3 \times \text{Founder}_{it} + \\ &+ \beta_4 \times \text{Gender}_{it} + \beta_5 \times \text{Grey}_{it} + \\ &+ \beta_6 \times \text{Indep}_{it} + \beta_7 \times \text{State}_{it} + \\ &+ \beta_8 \times \text{Strategic}_{it} + \beta_9 \times \text{Board}_{it} + \\ &+ \beta_{10} \times \text{Controls}_{it} + \varepsilon_{it}\end{aligned} \quad (2)$$

Where i is the number of firm; t is a year and j is the proportion of shareholding held by the first five major shareholders (%); $Performance_{it}$ is measured by Tobin Q, ROA, ROE; $Grey_{it}$ is the proportion of shares held by grey institutions (%); $Indep_{it}$ is the proportion of shares held by independent institutions (%); $Strategic_{it}$ is the proportion of shares held by strategic owners; Top is the proportion of shares held by the top five, twenty, fifty

shareholders (%); Majors is the proportion of shares held by first, second, third, fourth, fifth shareholders (%) ; $Board_{it}$ is the vector of board characteristics: Board Size, Independent Director (%), Women Director (%). $Controls_{it}$ is the vector of control variables including firm size, leverage, R&D, company age, Sales growth and EBITDA volatility. We will further carefully explain and provide examples to prove the adequacy of the model. Definitions of all variables are presented in Table 3 in the Appendix.

We use GLS model estimation with robust standard deviation. We used both Fixed and Random effects model, using the Hausman test to prove the right specification. In order to avoid missing variables problem, we used windsorized variables in regression analysis. Also, we provide some evidence of an absence of endogeneity problems. We check endogeneity by IV 2SLS method. Using VIF matrix we reject multicollinearity problem.

Dependent Variables

The firm performance is measured by both accounting-based and market-based criteria. We use different corporate performance measures in order to examine both the backward-looking and forward-looking perspectives (Shan, McIver, 2011 [33]). Tobin Q is a measure of firm value and could reflect corporate governance decisions as well as liquidity and intangibility (Li et al., 2015 [34]). whereas ROA reflects the operating performance. Both measures have its advantages and disadvantages. For instance, Tobin Q is subject to price fluctuations, investors attitudes (corporate takeover abnormal returns), but is good in reflecting growth opportunities of a firm, whereas ROA is not affected by the market situation, but is focused on the current performance (Cornett et al., 2007 [35]). Thus, we expect the difference in the obtained results for different performance measures. This could give us an opportunity to compare both the effectiveness of operating and market performance of a firm. We will use Return on Equity (ROE) as a robustness check for the model specification.

Independent Variables

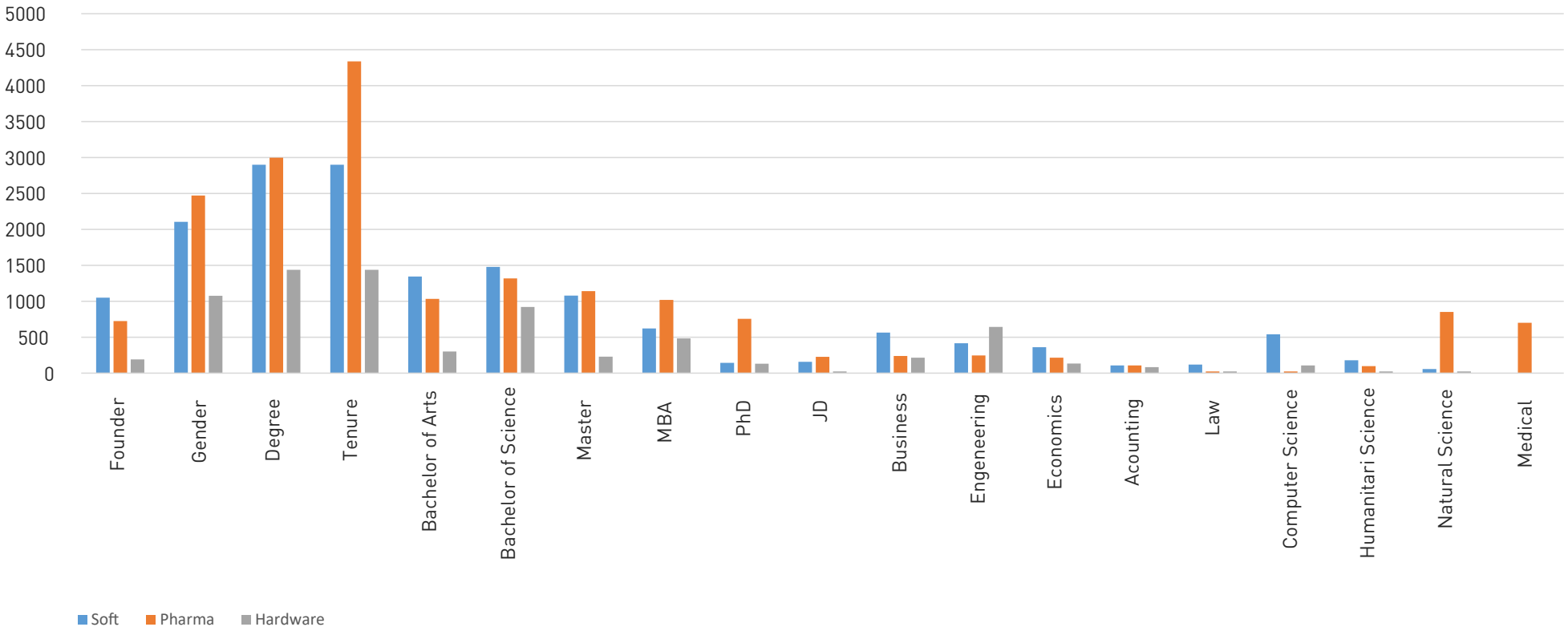
We use collected information about CEO: degree, the sphere of education, tenure, gender and was he/she founder. We postulate that investor could appreciate boards with higher level of educational background. Darmadi (2013) [36] found that educational qualifications positively associated with Tobin Q and ROA of 160 Indonesia Stock Exchange. Also, we assume that financial education of CEO is more importantly for bigger firms, because of their business complexity. For example, Chen (2014) [32] analyzing the relationship between R&D intensity and board human capital on a large sample of Taiwanese electrical firms, found that CEO tenure and Board educational level positively influence on firm performance as well as R&D activity. Different methods were applied in the field of behavioral finance. Chiang et al. (2016) [37] implicate Accounting and Business background for Senior managers. We will take method of calculation CEO degree level, used by Barker and Mueller (2002) [38]. They scaled each educational degree by four-point scale: 0-no college degree, 1-Bachelor degree, 2- Masters, 3- Ph.D. or J.D. We also coded MBA =2, because in most studies the authors suggest that financial education is significant measure of human capital quality. Then, we calculated Degree variable as a sum of coded scale, Tenure as a difference between 2015 and CEO appointment, Founder as a Dummy variable, which equals to 1, if CEO is simultaneously founder or co-founder of a company, and Gender as a Dummy variable, which equals to 1 if the CEO is a man, and to 0 otherwise.

For all models we will also use the same vector of firm characteristics, that could either exacerbate the effect of ownership structure or add greatly to the firm performance. The size of board of directors is an important measure. It reflects the decision-making process within the firm. As suggested by the scholars the larger the board of directors the longer and more difficult is the arrival at a decision. But, from the alternative point of view the diversification of opinions due to different ethnical, sexual, geographical, educational, cultural and experienced members of the board give an opportunity to solve more sophisticated problems. Thus, exists the breakpoint of this double influence. The diversity of points of view present the benefit for innovative company`s performance, where the professional experience as well as the educational background could matter. Thus, for the board diversification measure we include the presence of a women in the board of directors (%Women), which is probably one of the worldwide economy trends (Terjesen et al., 2016 [39]). Women on the board presents not only the variety of opinions, they are commonly known as less risk-aversive. Furthermore, independent directors represent one of the ways of mitigation of potential agency conflicts between management and shareholders. Independence of the board are commonly viewed as a good signal of corporate governance, so, is associated with better performance (McConnell et al., 2008 [40]). In our analysis the independence of owners plays an important role because of their monitoring activity, thus, the presence of independent director on the board could potentially be the complement to the firm performance. So, we predict that higher percentage of independent directors on the board and the predominant presence of independent institutions enhance the firm value.

Control variables

In our paper we use several control variables previously applied in the academic literature. Following Lin et al. (2017) [41] we identify the potential relationship of firm performance with Firm Size (natural logarithm of total assets) and Leverage (market Value of Debt to total Market capitalization). We expect the positive relationship with firm size and negative with leverage. To measure the investment opportunities, we use antecedent growth in Sales (De-la-Hoz et al., 2016 [42]).

Figure 1. Distribution of CEO characteristics by High-Tech industry



Source: Capital IQ, authors calculations. On the Y-axis Number of observations.

The specification of our research is that we emphasis the difference in ownership structure in high-tech and non-tech industries. In order to catch this difference, we include R&D measure (logarithm of R&D), which minimizes the effect of a drop in R&D ratio during IPOs equity increases (Acharya, Xu, 2016 [43]). Moreover, we develop the hypothesis that company age is connected with the presence of several types of investors in the firm, because some have preferences in stability and others in growth opportunities, some have long-term incentives and others short-term. Thus, independent institutions with long-term orientation could potentially invest more in large, stable and mature firms. Thus, we expect a positive relationship between company age, firm performance and the presence of independent institutions. We measured the company age as the difference between 2015 and the foundation year. We have collected data for firm age from CIQ database, but for missing values we hand appended the sample. It is important to mention that in the case of spin-offs, subsidiaries, parts of conglomerate, we use the date of parent company foundation, because of the information and reputation of a company. For example, GCP Applied Technologies was established as a subsidiary of W.R. Grace & Co. in Columbia, Maryland in 2015. Its parent company spun off GCP Applied Technologies on January 28, 2016. We took the date of foundation of its parent company W.R. Grace & Co – 1854. Talen Energy is an independent power producer founded in 2015. It was formed when the competitive power generation business of PPL Corporation was spun off and immediately combined with competitive generation businesses owned by private equity firm Riverstone Holdings. Following these transactions, PPL shareholders owned 65% of Talen's common stock and affiliates of Riverstone owned 35%. PPL was founded in 1920. In order to link our hypothesis in terms of risk level we calculate the EBITDA volatility during three-year period as a proxy of risk level measure (Nashier et al., 2016 [44]).

Empirical Results

Following previous analysis of the ownership structure in our last paper (Karnoukhova, Stepanova, Kokoreva, 2018 [10]) we turn our view to the CEO's human capital research in innovative industry. For this purpose, we hand collected information about CEO: degree, the sphere of education, tenure, gender and was he/she founder. We have analyzed 270 CV from Pharmaceuticals, 250 CV from Software and 122 CV from Hardware industry (figure 1). On the figure we see the difference in CEOs characteristics between tree innovative industries. We see that in Pharmaceutical companies, CEOs have more tenure, higher degree of education and more male CEO. In the Software industry CEOs are more likely to be founders in comparison with Hardware industry. CEOs in Software industry have on average more Bachelor degree in science than in other industries. In the Hardware industry CEOs are more likely to have a Bachelor degree in engineering than in other industries. PhD level of education is propagated in Pharmaceutical industry.

Firstly, we separately analyzed the influence of CEO characteristics on the firm performance (Table 1). In general, we suggested the positive influence of CEO`s degree, tenure and founder CEO on the firm performance. However, we found that, in general, these characteristics are significant, but their signs vary across industries and specifications. The CEO-founder positively affects accounting measures of firm performance, and negatively or insignificant on market firm performance.

As we expected, we observe different influence of CEO personality on firm performance across sectors. Let us start the analysis from the Software & Services sector. Interestingly, in this sector the only important factor for firm performance is whether the CEO is still a founder of a company. Founding CEO contributes to ROA by 0.2pp. Difference occurs, when we compare Biotechnology and Hardware industries. And, we finally obtain convergence in firm performance measures. All in all, the higher the degree of education of CEO, the higher the firm performance. It could be argued, that, in practice, pharmaceuticals companies are founded and created by one or a group of scientists with secondary education level (Bachelor of science in physics, chemical, biology etc.), but, they may not desire to become CEO. They will appoint external professional at latter stage of lifecycle. It should be noted that there is a lot of new appointment on the CEO chair, and this new people are predominantly insiders with previous experience in the industry with high education level with three or four degree (B.S, M.D., MBA, PhD). And others are founders, which either at once became CEO or after few years, and they have not so much educational experience (only B.A. or B.S.). Mr. Vivek Ramaswamy is the Founder of Roivant Sciences, Inc. and serves as its Chief Executive Officer since March 2015, and has a A.B. in Biology. And a counterexample: Dr. Martine A. Rothblatt, Ph.D., MBA, J.D., Founded United Therapeutics Corporation in 1996, and has been its Chief Executive Officer since June 26, 2016 and as its Chairman since 1996. That is why tenure is also negatively associated with firm performance.

There is a high impact of CEO-founder on ROA and ROE. This result confirms conclusions conducted on the large panel of US IT companies in recent paper of Chiu, Chen, Cheng, Hung (2019) [45]. Alike the authors we show that CEO-founder have more power, which lowers agency costs and enhances long-term firm performance. Pharmaceutical business is entrepreneurial business, which frequently further transform into the family business. As opposed to Hardware & Equipment industry, with the least number of CEO-founders, (except Facebook, Apple and Google), tenure and educational degree are highly significant (at 5%) for firm performance.

Interestingly, the presence of male CEO increases firm profitability in this sector, which is explained by prevalence of male members. However, this result cannot be treated as a robust result, since there is only one female CEO among 121 companies. Ms. Cheryl Podzimek Beranek, also known as Cheri, has been the Chief Executive Officer and President at Clearfield, Inc. since June 28, 2007.

Table 1. CEO characteristics and technological firm performance

	Software & Services		Pharmaceuticals, Biotechnology & Life Sciences			Technology Hardware & Equipment		
VARIABLES	Tobin Q	ROA	Tobin Q	ROE	ROA	Tobin Q	ROE	ROA
Degree	-0.0242	0.0484	-0.112*	1.316	1.556**	0.176***	1.881*	0.826*
	(0.0445)	(0.395)	(0.0610)	(1.248)	(0.743)	(0.0552)	(0.972)	(0.496)
Founder	-0.0171	0.216*	-0.0214	0.882**	0.721***	-0.0222*	-0.0834	-0.0805
	(0.0133)	(0.118)	(0.0209)	(0.445)	(0.260)	(0.0131)	(0.234)	(0.120)
Tenure	0.00659	-0.159	0.00265	-1.074**	-0.671***	-0.00149	0.547**	0.235**
	(0.0134)	(0.120)	(0.0201)	(0.440)	(0.245)	(0.0129)	(0.230)	(0.118)
Gender	0.483*’	2.733	0.256	3.899	6.127	-0.344	2.791	5.257*
	(0.295)	(2.598)	(0.349)	(6.836)	(4.246)	(0.343)	(5.929)	(2.896)
Board Size	-0.0506	-0.663*’	0.0386	0.448	-0.925	-0.0732*’	-1.292*’	-0.310
	(0.0510)	(0.452)	(0.0623)	(1.247)	(0.783)	(0.0469)	(0.837)	(0.418)
Women %	0.0290***	-0.228***	0.0138	0.0903	0.0758	-0.0207**	-0.163	-0.0300
	(0.00843)	(0.0746)	(0.0111)	(0.229)	(0.137)	(0.00893)	(0.155)	(0.0788)
Independent D%	-0.00351	0.0704	-0.0205**	0.0996	0.0156	-0.00168	0.109	-0.0333
	(0.00689)	(0.0609)	(0.00985)	(0.198)	(0.115)	(0.00657)	(0.119)	(0.0603)
Firm Size	-0.612***	3.062***	-0.727***	21.19***	12.29***	-0.209**	6.482***	2.388***
	(0.100)	(0.883)	(0.0958)	(2.022)	(1.202)	(0.0985)	(1.679)	(0.794)
R&D	0.456***	-0.385	0.575***	-8.957***	-1.768	0.0540	-2.324	-0.160
	(0.0803)	(0.711)	(0.0970)	(1.993)	(1.242)	(0.0813)	(1.461)	(0.717)

	Software & Services		Pharmaceuticals, Biotechnology & Life Sciences			Technology Hardware & Equipment		
VARIABLES	Tobin Q	ROA	Tobin Q	ROE	ROA	Tobin Q	ROE	ROA
Leverage	-0.0176***	0.119***	-0.0145***	-0.0741	0.0367	-0.00547**	0.146***	0.0403*
	(0.00449)	(0.0398)	(0.00376)	(0.0741)	(0.0486)	(0.00229)	(0.0412)	(0.0207)
Company Age	-0.00831**	-0.0468*’	0.00398	-0.238***	-0.0487	-0.00292	-0.493***	-0.202***
	(0.00366)	(0.0319)	(0.00346)	(0.0903)	(0.0425)	(0.00388)	(0.0776)	(0.0343)
Growth of Sales	1.402***	-2.218			5.201**	0.918***	-5.570	
	(0.279)	(2.408)			(2.526)	(0.255)	(4.467)	
Vol.3 EBITDA	0.000585	0.00366			-0.0166*	0.00112**		
	(0.000452)	(0.00400)			(0.00864)	(0.000459)		
Constant	5.803***	-21.57***	7.887***	-133.5***	-94.32***	4.557***	-32.09***	-12.82**
	(0.691)	(6.100)	(0.958)	(19.46)	(11.92)	(0.716)	(12.25)	(5.951)
Observations	429	437	467	410	464	301	300	317
R-squared	0.297	0.141	0.234	0.362	0.377	0.242	0.218	0.188
Number of Firms	124	119	124	130	115	125	74	74

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1, *’ p<0.15

Table 2. Investor type, CEO characteristics and firm performance

	Software & Services	Pharmaceuticals, Biotechnology & Life Sciences			Technology Hardware & Equipment		
VARIABLES	ROA	Tobin Q	ROE	ROA	Tobin Q	ROE	ROA
Top 5 Strategic	-0.0690	-0.0233**	-0.138	0.0586	0.0114*	0.184*	0.215***
	(0.0541)	(0.0111)	(0.240)	(0.131)	(0.00636)	(0.115)	(0.0604)
Top5 Grey (active)	-0.465	-0.103	-0.601	0.218	0.0319	0.283	0.0314
	(0.439)	(0.0971)	(1.903)	(1.184)	(0.0516)	(0.922)	(0.457)
Top5 Independent (active)	0.0744	-0.00890	-0.163	0.190**	-0.0240***	-0.384**	
	(0.0719)	(0.00777)	(0.163)	(0.0916)	(0.00919)	(0.166)	
Top5 State		0.0433**	-0.535	-0.311			
		(0.0184)	(0.407)	(0.225)			
Top5 Independent (passive)							0.420***
							(0.135)
Degree	0.0550	-0.147**	2.026*’	1.877**	0.165***	2.026**	0.944**
	(0.391)	(0.0624)	(1.287)	(0.740)	(0.0535)	(0.968)	(0.472)
Founder	0.253**	-0.0199	0.649	0.717***	-0.0165	0.0165	-0.0663
	(0.120)	(0.0214)	(0.457)	(0.254)	(0.0132)	(0.237)	(0.116)
Tenure	-0.162	0.00570	-0.849*	-0.641***	-0.00495	0.431*	0.261**
	(0.120)	(0.0206)	(0.450)	(0.241)	(0.0130)	(0.232)	(0.114)
Gender	3.376	0.296	5.145	5.989*’	-0.253	3.382	6.131**
	(2.607)	(0.352)	(6.937)	(4.163)	(0.329)	(5.879)	(2.823)
Board Size	-0.601	0.104*’	-0.0657	-1.282*’	-0.0946**	-1.590*	-0.432
	(0.447)	(0.0656)	(1.321)	(0.789)	(0.0466)	(0.835)	(0.409)

	Software & Services	Pharmaceuticals, Biotechnology & Life Sciences			Technology Hardware & Equipment		
VARIABLES	ROA	Tobin Q	ROE	ROA	Tobin Q	ROE	ROA
Women %	-0.223***	0.00909	0.164	0.137	-0.0197**	-0.210	-0.0325
	(0.0742)	(0.0115)	(0.240)	(0.137)	(0.00864)	(0.155)	(0.0755)
Independent D%	0.0122	-0.0150*’	-0.0863	-0.0288	0.00360	0.210*’	-0.0260
	(0.0671)	(0.0104)	(0.214)	(0.117)	(0.00702)	(0.129)	(0.0624)
Firm Size	3.415***	-0.759***	19.90***	11.89***	-0.180*	5.684***	1.524*
	(0.863)	(0.101)	(2.136)	(1.184)	(0.0926)	(1.683)	(0.812)
R&D	-0.293	0.548***	-8.196***	-2.483**	0.152*	-1.498	0.609
	(0.707)	(0.0991)	(2.056)	(1.179)	(0.0820)	(1.506)	(0.714)
Leverage	0.108***	-0.0158***	-0.0666	0.0217	-0.00465**	0.165***	0.0450**
	(0.0379)	(0.00381)	(0.0757)	(0.0461)	(0.00230)	(0.0414)	(0.0196)
Company Age	-0.0545*	0.00372	-0.217**	-0.0602*’	-0.00181	-0.481***	-0.173***
	(0.0322)	(0.00368)	(0.0971)	(0.0427)	(0.00388)	(0.0770)	(0.0331)
Growth of Sales	-1.633	0.00520	2.541	5.466**	0.868***	-6.702	-0.511
	(2.385)	(0.213)	(4.688)	(2.515)	(0.254)	(4.444)	(2.174)
Constant	-20.71***	7.579***	-108.3***	-86.80***	3.848***	-34.12**	-16.64***
	(6.480)	(1.051)	(21.93)	(11.88)	(0.729)	(13.33)	(6.234)
Observations	444	449	393	472	305	300	310
R-squared	0.142	0.238	0.335	0.381	0.256	0.243	0.240
Number of Firms	124	120	106	127	75	74	75

Also, CEO`s tenure was found significant for Pharmaceutical and Technology industries. However, the influence of tenure differs among these industries. In Pharmaceutical companies, tenure have a negative influence on firm performance, measured by ROE and ROA. We suggest that CEO with higher tenure in this industry, while accumulations knowledge over the years can become entrenched, and, subsequently, will try to avoid losses over pursuing gains (Luo, Kanuri, Andrews, 2013 [46]). On the other hand, CEO`s tenure in Technology Hardware industry seems to positively affect ROE, ROA. This result supports the view of Gunasekarage, Luong, Truong (2019) [47], that CEOs with a longer tenure could form such management structure, which will enhance firm performance.

Then, our next step is to analyze CEO characteristics in interference with different investor types (Table 2). For Software & Services industry we found out that CEO-Founder, which previously was not significant (Table 1), positively influence on ROA by outweighing impact of active independent investor type of firm performance. A similar effect is observable for Biotechnology industry, where in ROA specification Top 5 active independent investors (previously with negative sign) became positive, but the significance of all other investors disappears. When founder, degree and tenure become significant, investor`s type becomes insignificant or change its sign. More surprisingly, degree preserve its positive sign, and all previous results for Top5 Independent investors are conserved. This mean, that these CEO characteristics and investor`s type are highly important for this sector. Thus, we verify stability of influence of both investor`s type and CEO characteristics on firm performance.

Conclusion

In this paper we develop a hypothesis of complement influence of CEO characteristics on firm performance of technology companies. We contribute to the research of corporate governance and performance drivers in technology sectors. The finding suggests that such CEO characteristics as tenure, degree and is he/she a founder are important in Pharmaceuticals and Hardware industries, with high impact on firm profitability. These results are similar to those obtained by Lee, Kim, Bae (2020) [48], where CEO-founder generate more explorative innovations. We find the evidence that educational degree has a positive influence on firm profitability in both hardware and biotechnological sectors. This result is in line with previous results of Jiménez-Jiménez et al. (2011) [18] study. At the same time, we show that the market dislikes the situations when the biotechnological companies are managed by highly educated CEOs. We do believe that in biotechnology companies investors prefer the entrepreneurs and professional managers at the CEO position to the professors heading the research team. However, we found a positive relationship between tenure of CEO and firm performance for Technology Hardware industry (in line with Gunasekarage, Luong, Truong 2019 [47]), which contradicts to the result obtained for Pharmaceutical companies. In addition, we found practically no evidence concerning the board independence and ownership structure of innovative firms, that contradicts to the results on the role of independent directors received by Chen et al. (2016) [15].

This study contributes to the existing literature in two aspects. First, our findings indicate that CEO characteristics play crucial roles in explaining technology firm value and performance. We demonstrated that founding CEO contributes to technology firm performance as well as the CEO with better education. Some scholars found that powerful CEO lead to poor performance (Han, Nanda, Silveri, 2016 [49]), however, we found that powerful and smart CEOs can contribute to better performance and stronger survivability as Chiu, Chen, Cheng, Hung (2019) [45]. Second, CEOs should be smart and powerful in order to sustain firm performance. We found that CEOs characteristics mitigate the conflicts between different types of investors and their influence on firm performance.

There is a number of practical implications of this study. First of all, we conducted our analysis on a large sample of US firms, taking into account more than 98% of US capital market. Secondly, we used a new procedure of scaled degree test for CEO characteristics, which was not previously tested on US market. Thirdly, we supplement the presented results by real examples of the sample, that prove the validity of our research.

For future studies, we provide an opportunity to test a nonlinear relationship between CEO characteristics discussed above and firm performance. We suggest to add in future research CEO power index, measured following Lee, Kim, Bae (2020) [48], as a dummy variable that equals 1 when the CEO is the founder, has duality, or is an insider. It is also important to take into account risk preferences of the CEO, which should also influence the firm performance (Anilov, Ivashkovskaya, 2019 [50]). We also reveal the importance to further analyze the board diversity in educational and professional background.

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Appendix

Table 1. Descriptive statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
		Dependent variables			
Tobin Q	9213	2.482678	1.709054	.8939	8.4492
ROE	8724	6.145749	19.43469	-36.649	29.895
ROA	9703	-2.045606	22.22631	-83.7228	23.8757
		Independent variables			
Top 5 Grey (active)	12564	.3563451	2.385981	0	66.984
Top 5 Grey (not active/passive)	12564	.547063	3.438737	0	68.372
Top 5 Independent (active)	12564	8.905715	11.64401	0	163.879
Top 5 Independent (not active/passive)	12564	2.854993	5.254732	0	82.272
Top 5 Independent (passive)	12564	4.043734	5.890471	0	66.533
Top5 Strategic	12564	8.656271	16.73545	0	164.624
Top5 State	12564	1.016903	6.183102	0	92.296
Board Size	5873	8.805158	2.241266	1	19
Women on Board (%)	5851	11.15278	10.14136	0	71.429
Independent Director (%)	5827	77.87007	12.23409	44.444	91.67
Leverage	10182	23.03372	26.65251	0	106.59

Variable	Observation	Mean	Std. Dev.	Min	Max
Firm Size	10026	6.726709	1.820372	2.911823	10.60352
R&D	5967	3.616425	1.832616	.1823216	8.108322
Company Age	12480	42.05329	37.88536	3	145
growth of Sales	9115	.1627667	.3276786	-.3836548	1.484608
Vol. 3 EBITDA	8119	83.11091	167.5665	1.181395	847.2207
Tenure	7332	6.615248	7.316767	0	50
Founder	1966	.9389624	.2394603	0	1
Gender	9536	.9365562	.2437722	0	1
Degree	7334	2.653941	1.645846	0	8

Table 2. CEO characteristics

	Software & Services					Pharmaceuticals, Biotechnology & Life Sciences					Technology Hardware & Equipment				
Variable	Obs	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max
Founder	1049	.8856053	.3184418	0	1	725	1	0	0	1	192	1	0	0	1
Gender	2104	.9477186	.2226468	0	1	2470	.9076923	.2895184	0	1	1075	.9572093	.2024791	0	1
Degree	2898	2.358178	1.624822	0	8	2998	3.178119	1.636757	0	8	1438	2.157163	1.384495	0	6
Tenure	2898	7.704279	7.569208	0	36	4336	7.346402	7.636006	0	36	1438	6.625174	7.721265	0	35
Bachelor of Arts	1344	.9308036	.2538823	0	1	1032	1	0	1	1	302	1	0	1	1
Bachelor of Science	1479	.9546991	.257453	0	2	1318	1	0	1	1	920	1	0	1	1
Master	1079	2	0	2	2	1140	1.936842	.2433535	1	2	229	1.947598	.223324	1	2
MBA	621	1.961353	.2755419	0	2	1018	2.011788	.107983	2	3	483	2	0	2	2
PhD	144	3	0	3	3	755	2.968212	.1755517	2	3	132	3	0	3	3
JD	157	3	0	3	3	227	3	0	3	3	24	3	0	3	3
Business	565	1	0	1	1	240	1	0	1	1	216	1	0	1	1
Engineering	416	1	0	1	1	245	1	0	1	1	643	1	0	1	1
Economics	360	1	0	1	1	216	1	0	1	1	134	1	0	1	1
Accounting	107	1	0	1	1	108	1	0	1	1	84	1	0	1	1
Law	120	1	0	1	1	24	1	0	1	1	24	1	0	1	1
Computer Science	541	1	0	1	1	24	1	0	1	1	108	1	0	1	1
Humanitarian Science	180	1	0	1	1	97	1	0	1	1	24	1	0	1	1
Natural Science	57	1	0	1	1	852	1.014085	.1179087	1	2	24	1	0	1	1
Medical Doctor	0					701	1	0	1	1	0				

Table 3. Definition of variables

Dependent variables	
Tobin Q	Ratio of Market Capitalization to Total Assets
ROE	Net Income to Total Shareholder Equity
ROA	Net Income to Total assets
Independent Variables	
	Ownership structure
Independent Institutions	Institutional ownership held by independent institutions (traditional Investment Managers, Hedge Funds Managers) as a percentage of market capitalization
Grey Institutions	Institutional ownership held by grey institutions (Banks, Pension Funds, Educational/Cultural Endowments, Insurance companies, REITs, Family Offices trusts) as a percentage of market capitalization
Top 5 Grey (active)	The percentage of corporate shares held by first five grey institutions with active strategy (Banks, Educational/Cultural Endowments, Family Offices trusts)
Top 5 Grey (not active/passive)	The percentage of corporate shares held by first five grey institutions with not active/passive strategy (Banks, Educational/Cultural Endowments, Family Offices trusts, Insurance Companies, Pension Funds, REITs)
Top 5 Independent (active)	The percentage of corporate shares held by first five independent institutions with active strategy (Traditional Investment Managers, Hedge Funds Managers)
Top 5 Independent (not active/passive)	The percentage of corporate shares held by first five independent institutions with not active/passive strategy (Traditional Investment Managers, Hedge Funds Managers)
Top 5 Independent (passive)	The percentage of corporate shares held by first five independent institutions with passive strategy (Traditional Investment Managers)
Top5 Strategic	The percentage of corporate shares held by first five strategic institutions (Individual/Insiders, Corporations (public), Corporations (private), Company Controlled Foundations, VC/PE firms)
Top5 State	The percentage of corporate shares held by first five state institutions (Sovereign Wealth Funds, State Owned Shares)

Independent Variables	
Corporate Governance	
Board Size	The number of directors in the board of directors
Women on Board (%)	The percentage of women in the board of directors
Independent Director (%)	The percentage of independent directors in the board of directors
Control Variables	
Firm Size	The natural logarithm of Total assets
R&D	The natural logarithm of R&D spending
Company Age	The difference between the year of foundation and 2015
Leverage	Total long-term debt divided by total assets
growth of Sales	The percentage change of the average sales volume year by year
Vol. 3 EBITDA	Three-year standard deviation of EBITDA
CEO characteristics	
Tenure	The difference between year of appointment and 2015
Founder	Dummy variable, which equals to 1, if CEO was a founder (co-founder) of a company, 0-otherwise.
Gender	Dummy variable, which equals to 1, if CEO is male, 0-otherwise.
Degree	Accumulated score of educational level: Bachelor =1, Master=2, Ph. D. =3.

Designing New Funding Models for Russian Football Clubs

Ilia Solntsev
PhD, Director of Sports Research Department
Associate Professor of Corporate Finance and Corporate Governance Department
ORCID
E-mail: ilia.solntsev@gmail.com

Plekhanov Russian University of Economics, Moscow, Russia
Financial University under the Government of Russian Federation, Moscow, Russia

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Designing New Funding Models for Russian Football Clubs

Abstract

In Europe, most football clubs have long been positioned as business projects, which are active in financial markets and apply various funding tools. The 2018 FIFA World Cup inspired a new wave of interest in Russian football and created attractive conditions for applying new funding tools. The specifics of the economy surrounding sports development in Russia have led to a situation whereby most sports clubs depend on limited apportionments of budgetary funds, and require novel sources of additional funding for different development purposes, e.g. constructing stadiums, training grounds, youth academies and everyday operations.

The aim of this research is to examine the best foreign practice in the field of attracting funding by sports clubs and propose adaptations for Russian conditions. This work presents a practice-oriented review of the most modern funding tools used in football, and analyses the capital structure of European football clubs, their funding policies and preferences.

The competitive level of the European and Russian clubs, their relative financial capabilities, and their development prospects were considered, and the analytical mapping process ascribed prospective investment ratings to the Russian clubs. In a similar manner, recommendations as to how practical funding examples from European clubs may be adapted and followed in the Russian context are described. By comparison and contrast, likely candidates among Russian clubs for similar economic strategies are identified. The sources of information utilised for this process include annual reports from European football clubs, research studies, and academic articles, along with any available contextual information on Russian clubs.

The study was limited by the secrecy of reporting in Russian football and the weak financial position of most Russian clubs, which restricts their funding opportunities. However, despite the special development model of domestic Russian football and the harsh economic conditions, the proposals formulated in this work can be implemented into the practical activity of any club, regardless its scale and can contribute to improving financial sustainability, competitive results and the integrated development of Russian clubs. The methods proposed can act as a catalyst for the gradual corporatisation of Russian football clubs and will be of interest to investors, business analysts, economic scientists and football fans alike.

Keywords: bond interest rates, international financial markets, financial instruments, industry studies: sports

JEL classification: G12, G32, Z23

Introduction

If we assume that a football club is a fully-fledged business unit (which has been proven in practice globally), we may articulate that a standard set of instruments can be used to finance it [1]:

1) Internal (profit and depreciation)
2) External: debt and joint-stock capital

In this paper we will consider the above instruments taking into consideration the specifics of the football business.

Internal sources of revenue are generated in the course of the company's business operations. A football club's revenue traditionally consists of profits from the day of the match (ticket and season ticket sales, catering and merchandising), sale of media rights, and sponsorship agreements. The major individual feature of a football club's business is the dependence of all the above items on the match result which almost cannot be predicted. In the case of Russia, additional limitations include the weak development of the sports industry in general, the supporters' unreadiness to pay serious sums, and weak business management. In aggregate, all the above are reasons for the inability of the majority of clubs to generate serious earnings and, as a consequence, they require external sources of funding.

In order to finance investment projects and to cover the operating capital, companies use borrowed funds: bank credits, bonded loans, leasing, loans via a promissory note, etc. From an economic point of view, all these instruments are an unconditional obligation to repay the obtained amount and the pre-agreed remuneration by a specified date. As such, we will consider further the most popular debt instruments: bank credits and bonded loans as well as raising of the share capital through IPO.

Debt instruments

In general, irrespective of the instrument, the advantages of debt funding comprise the fact that it does not imply interference with the company management and gives an opportunity to save on income tax. Moreover, such instruments are characterised by a high value, and a range of covenants and support requirements.

According to UEFA [2] the net debt[1] of the 20 most debt-laden European clubs exceeds €4.7 billion (table 1), and the total net debt of all clubs amounts to €6.8 billion.

The classical instrument of debt funding is ***credit***. Taking into consideration the specifics of the football industry the most probable purposes for using this particular instrument of business financing are as follows: financing of capital investments (for example, construction of a stadium, academy, training grounds), or the refunding of formerly-raised borrowed funds. However, in practical terms an obligatory condition for the granting of credit is a security whose value should cover the principal debt, the interest, and the possible expenses of its fulfillment. This condition may become problematic for a football club. The central matter is that its key assets are intangible (in practical terms, the key asset of any club is its supporters) and its infrastructure (the stadium, training facility) have a low liquidity value.

Often, the raising of credit by a football club is related to a change of the club owner (see some examples below). Another prevalent situation is gaining a credit for construction of a stadium. So, the English club Tottenham Hotspur in 2016 started construction of its new home stadium. In order to fund the construction in 2017 the club raised a 5-year credit granted by a banking syndicate (HSBC Bank, Goldman Sachs Bank and Bank of America Merrill Lynch) which totaled £400 million. A floating interest rate at LIBOR + 225-300 basis points was set for the credit, the security for which was the new stadium and the revenues related to it. In October of 2018, an increase of the credit value by £100 million was declared which happened because of the growth of the stadium's estimated cost. The stadium was subsequently constructed, the associated areas were furnished at the beginning of 2019, and on 3 April the first home match took place at the new stadium.

Securitisation is often used in the football business as a financing method. It implies that the club sells a part of its future revenues in advance and uses the money to construct a stadium [3]. Typical securitisation items are revenues from the sale of stadium naming rights or from the sale of premium class tickets and season passes. For example, before the new stadium of Stock City was opened in 1997 the stadium naming right had been sold to the company Britannia. Another example is the agreement of Arsenal with the company Emirates: apart from a sale of the naming rights, the agreement provided for the sale of the right to advertise on football jerseys, which were primary financing instruments behind the construction of their new stadium. In practice, several financial instruments may be applied. For example, as in construction of the Juventus stadium the following financing methods were established [4]:

1) a long-term partnership agreement with Sportfive Italia S.p.A. which got the exclusive right to sell the new stadium naming rights and a part of closed sky boxes and VIP seats. The term of the partnership is 12 years from the date of completion of the stadium's construction. The minimum amount due to Juventus under this agreement is 75 million Euro;
2) a credit agreements amounting to 60 million Euro. The credits' period is 12 years. The sources of

[1] As defined by UEFA, the net debt is calculated as the aggregate value of net borrowings (bank overdrafts, bank credits and other loans, accounts payable to the group companies and other related entities after deduction of cash and its equivalents), net balance of payments as a result of the club players' transfers (the difference between the accounts receivable concerning players' transfers and accounts payable concerning players' transfers) and accounts payable to social funds and tax authorities (long-term).

repayment are the revenues from Sportfive and gate revenues. The credit is secured by mortgage and the guarantee issued by Instituto per il Credito Sportivo;

3) 3) a contract for the construction of a shopping center in the territory immediately adjacent to the stadium by Nordiconad Group. The contract value amounted to 20.25 million Euro.

An interesting situation has come about in Turkish football. Apart from raising funds in the stock market, Turkish football clubs, especially the "Big Four" (Besiktas, Fenerbahce, Trabzonspor and Galatasaray), operated actively in the debt market as well. At the beginning of 2019 the total debt owed to banks by Turkish clubs amounted to 11 billion Turkish liras ($2 billion). Due to economic decline in the country, the clubs could not repay the majority of loans, and as a result even the national championship was under challenge.

However, at the beginning of January of 2019 at the meeting of the heads of Super League members, representatives of the country bank association, and the president of the Turkish Football Federation, a decision to grant financial assistance to these clubs was adopted.

Table 1. European football clubs with the highest net debt

#	Club	Country	Net debt in financial year 2017, € million	Growth of net debt year/year	Net debt to revenue ratio
1	Manchester United	England	459	-18%	0.7x
2	Inter	Italy	438	44%	1.6x
3	Atletico	Spain	391	44%	1.4x
4	Juventus	Italy	289	2%	0.7x
5	Milan	Italy	272	30%	1.4x
6	Benfica	Portugal	269	-13%	2.1x
7	Galatasaray	Turkey	229	13%	2.3x
8	CSKA	Russia	229	18%	3.4x
9	Liverpool	England	225	-17%	0.5x
10	Roma	Italy	219	-14%	1.3x
11	Fenerbahce	Turkey	215	44%	1.8x
12	Valencia	Spain	213	-12%	2.1x
13	Sunderland	England	185	3%	1.3x
14	Porto	Portugal	177	10%	1.8x
15	Lyon	France	174	-31%	0.9x
16	Schalke 04	Germany	158	21%	0.7x
17	Besiktas	Turkey	154	8%	1.0x
18	Monaco	France	147	13%	1.0x
19	Middlesbrough	England	146	-	1.0x
20	Copenhagen	Denmark	143	10%	2.7
Sum/ weighted average			4,731	5%	1.2x

Source: report of UEFA Club Licensing Benchmarking Report, Financial Year 2017

Table 2. Circulated bonds of European football clubs

Club	Country	Currency	Coupon	Date of placement	Maturity date	Issuing volumes
Arsenal	England	GBP	5.14	13.07.2006	01.09.2029	210,000,000
Arsenal	England	GBP	1.40	13.07.2006	01.09.2031	50,000,000
Inter	Italy	EUR	4.88	14.12.2017	31.12.2022	300,000,000
Hertha	Germany	EUR	6.50	31.10.2018	08.11.2023	40,000,000
Juventus	Italy	EUR	3.38	13.02.2019	19.02.2024	175,000,000

Source: comprised by the author on the basis of Bloomberg data

When it comes to examples of crediting Russian football clubs, there are extremely few of them. Neither are they to be easily discovered in public, the activity of almost all clubs being financed directly by shareholders or sponsors. One of the most recent examples of raising funds is the credit obtained by CSKA from Vnesheconombank (VEB). According to RBC[2] in March of 2013 VEB granted to CSKA a credit line for $280 million in order to build a new stadium on the security of 684 shares of the football club (24.8%). In June of 2013 VEB signed an agreement for raising $230 million from the Bank of America, Sumitomo Mitsui Finance Dublin Limited and Sumitomo Mitsui Rus Bank to finance construction of a stadium for CSKA. According to the report made by Bluecastle Enterprises in May of 2014, a supplementary agreement to the shares security agreement was concluded. As a security of the credit VEB obtained from CSKA 2,112 shares, i.e. the security increased up to 76.4% of the football club shares.

Another popular debt funding instrument is the issuing of ***bonds***. The main parameters informing their use are the amount of bonds issued, nominal value, coupon value, coupon payment frequency and the bond maturity period. The main advantages of bonded loans are as follows:

- fundraising for a long-term period;
- an opportunity to attract a wide range of investors;
- independence of an individual creditor;
- an opportunity of operative administration of the debt structure by conducting operations in the secondary market;
- more flexible forms of security.

It should be taken into consideration that a long preparation process precedes the actual placement of bonds and among other things it implies recruitment of external consultants. Besides, account must be taken of the fact that placement of a bond entails disclosure of full information on the company operations which is not always acceptable for a modern football club.

According to the data, as of March 31, 2019 there were several bond issues in circulation made by football clubs which are available to a wide range of investors. Their issuers are football clubs of England, Italy and Germany of the leading European Championships (table 2).

One of the first and best-known examples of bond placement by a football club is Eurobonds, issued by Arsenal Football Club.

In the middle of 2006 the club placed two tranches of secured bonds, whose total value was £260 million. The first issue, amounting to £210 million, was placed with a fixed coupon rate of 5.14% per annum to be paid in equal shares biannually (Bloomberg ticker - AFCPZ 5.1418 09/01/29, ISIN - XS0261374200). The par value of a bond is £50,000. The depreciation repayment structure is envisioned for it. According to this, the investor is paid a predetermined part of the bond par value on each second date of coupon payment starting from the first coupon payment. For the second issue, which amounts to £50 million, a floating coupon rate is provided. Its value is defined for the next coupon period by the following formula: a 3-months LIBOR rate in £ + 55 basis points (up to September of 2013 22 basis points were added to the LIBOR rate) (Bloomberg ticker - AFCPZ 0 09/01/31, ISIN - XS026137454). The par value of a bond of this issue also amounts to £50,000, however, in accordance with the depreciation structure the investor gets a part of the par value only starting from 2029. The money raised in the process of bond placement was used to refinance bank loans related to engineering and construction of the Emirates Stadium.

A new stage of bond placement by football clubs took place at the end of 2017.

In December, the Italian football club Inter offered 5-years secured bonds in Euro to investors with a fixed coupon of 4.875% (Bloomberg ticker - INTERM 4 7/8 12/31/22, ISIN - XS1739592142). The legal entity Inter Media and Communication S.p.A (which is the only manager and operator of media, broadcasting and sponsor business of the football club) was the bond issuer. The club managed to raise €300 million which was used mainly to refund the club's existing debt.

[2] https://www.rbc.ru/economics/19/06/2014/57041e789a794760d3d3f748

At the end of 2018 the German club Hertha also enetered the bond market, placing €40 million of the senior unsecured debt (Bloomberg ticker - HERTHA 6 ½ 11/08/23, ISIN - SE0011337054). In that case the club was borrowing funds for the following purpose:

- complete or partial redemption of debt;
- payment of the penalty related to termination of contracts with Cortland Investors S.à r.l.;
- financing of expenses related to placement of bonds;
- financing of the club's operations.

The latest example of a successful placement of bonds by a football club is the senior unsecured debt of the Italian club Juventus (Bloomberg ticker - JUVEIM 3 3/8 02/19/24, ISIN - XS1915596222). In February of 2019 the issuer raised €175 million, offering 5-year bonds in Euro to a wide range of investors with a fixed coupon of 3.625%, to be paid once a year. Unlike the previous examples, in this case Juventus came into the debt market in order to obtain funds to finance the club's current operations instead of refinancing the existing debt.

However, the high degree of uncertainty of football results, financial indicators' volatility, and a lack of solid experience in interaction with financial instruments, all result in the fact that football clubs have to offer a high premium in order to raise the necessary funds when they enter the debt market.

Another important factor for debt instruments is the low amount of coverage of football clubs by rating agencies. This impedes assessment of risks of investment in the instruments of a certain issuer in accordance with the developed rating scale.

The credit rating is an opinion of a rating agency (national or international) on the issuer's business solvency or creditworthiness. At the moment there are 3 international agencies (Fitch, S&P and Moody's) whose ratings are generally accepted as illustrating the risks of investment when featured in a particular debt instrument .

Usually a rating is assigned to each particular bond issue and this rating may differ upwards and downwards in comparison to the issuer's rating. This is due to the specific parameters of the issue including the debt seniority, level of debt security, etc.

Not a single agency assigned ratings to 2 out of 5 issues circulating in the market (JUVEIM 3 3/8 02/19/24 and HERTHA 6 1/2 11/08/23), and Inter's issue (mentioned above) was assigned "BB-" rating by S&P agency, two Arsenal's issues have investment ratings "BBB" и "A-" assigned by Fitch and S&P respectively (table 3).

First of all, an absence of ratings means that the cost of raising funds using debt instruments increases for the issuer.

Wins and losses in the Champions League at the beginning of 2019 (which influenced the dynamics of the club shares) resulted in a high volatility of Eurobonds with a maturity date in 2024 as well. For 2 months these bonds were traded in the wide range of 95-99% of the par value and the yield to maturity, which amounts to 4.5% at a moment, in mid-April returned to 3.7-3.8%, which is a rare eventuality for such instruments.

Also an important point for the issuer as well as for the investor is the existence of call options, i.e. an opportunity for a club to redeem bonds from the market at a certain moment at a predetermined price. On the one hand, the existence of call options potentially limits the duration of the issue and consequently reduces the interest rate risk for the investor. On the other hand, its existence leads to a limited potential for the growth of bond quotations and there arises a risk that the investor will have no opportunity to place money at the same rate when exercising the call option.

Football clubs use this instrument extensively because they presume that while the bonds are in circulation their credit quality improves and there will be an opportunity to refinance the debt at terms more favourable for the club. It therefore influences the mechanism of evaluation of the issue market value.

Table 3. Data on the credit ratings of outstanding bonds of European football clubs[3]

Ticker	ISIN	Issuer	Fitch	S&P	Moody's	Average rating
AFCPZ 5.1418 09/01/29	XS0261374200	Arsenal	BBB	A-	-	BBB+
AFCPZ 0 09/01/31	XS026137454	Arsenal	BBB	A-	-	BBB+
INTERM 4 7/8 12/31/22	XS1739592142	Inter	-	BB-	-	-
HERTHA 6 1/2 11/08/23	SE0011337054	Hertha	-	-	-	-
JUVEIM 3 3/8 02/19/24	XS1915596222	Juventus	-	-	-	-

Source: comprised by the author on the basis of S&P, Fitch and Moody's data

3 Source: compiled by the author on the basis of data provided by rating agencies S&P, Fitch and Moody's

So, the structure of issue of Eurobonds by Inter implies the possibility to redeem the bonds on any date after 31.12.2019 at the price of 102.438% of the par value, after 31.12.2020 – at 101.219% and after 31.12.2021 – at 100%. According to Bloomberg (as of April 15th 2019) the bonds were traded at 102.619% of the par value. This makes it necessary to calculate the issue profitability on the basis of the nearest call option date, since in less than a year the bonds may be redeemed at a lower price than the current market quotation.

In case of bonds placement the crucial question is defining the coupon rate at which the club may raise funds. Here the risk-profitability ratio enters into the foreground.

The key parameter which helps to assess the issuer's credit risk is the credit rating. Precisely the assumption of the rating which may be assigned to Russian clubs will help to define the rate at which they will be able to raise funds.

Unfortunately, coverage of football clubs by rating agencies is extremely limited at present. One of the latest documents in this sphere is the methodology of assigning ratings to football clubs developed in 2018 by Fitch [5] agency which takes into consideration the following factors (Key Rating Drivers):

- League Business Model - Revenue Risk: the agency analyses the league strength, revenue structure, quality of national TV contracts, players' wage pattern, popularity and historical fan support, opportunities for growth, and control over the clubs;
- Franchise Strength - Revenue Risk: the team's ability to generate cashflow;
- Facility Infrastructure Development and Renewal: the agency analyses the club's opportunities for maintenance, reconstruction, and modernisation of infrastructure facilities;
- Debt Structure: Fitch analyses the debt structure, terms of repayment of obligations, sufficiency of liquidity and limits for increase of the debt load; and
- Financial Profile: the agency evaluates historical and projected cash flows of the club necessary for operating expenses.

On the basis of analysis of these indicators the rating agency includes the football club in one of 3 groups (Stronger, Midrange, Weaker) and assigns a credit rating to it.

The agency S&P [6] uses a similar approach. In 2014 it offered the model of the Virtual Credit League where football clubs were ranked on the basis of 24 financial indicators arranged into 3 sections: business operations, solvency, and liquidity. In each of those sections a club was assigned one of 4 categories: top, above average, below average, and minimum.

It should be noted that not a single methodology detailed thus far offers the list of indicators used for assessment. Only a part of them is mentioned: operating income margin, return on equity, asset turnover, total debt to equity ratio. Also, absence of special indicators which characterises special aspects of the football business stands out. For these purposes, papers dedicated to the development of criteria for football clubs' performance efficiency and business solvency may be used [7, 8]. Also in this respect the rules of UEFA financial fair play are critical [9].

Thus, on the basis of the existing methodologies of Fitch and S&P, and in accordance with relevant research, a proprietary methodology of credit ratings assignment to football clubs in three categories may be developed (table 4).

Table 4. Criteria for building up the credit ratings of football clubs

	Stronger	Midrange	Weaker
Income and expenses, liquidity			
Existence of income items exceeding 30% of revenue	The revenue is diversified maximally and no single income stream exceeds 30% of overall revenue	The revenue is diversified, one income item is ≥ 40% of overall revenue	Existence of income items exceeding 30% of revenue
Financial result	Net profit for the previous 3 seasons	1 loss-making season out of three previous ones	2 (and more) loss-making seasons out of three previous ones
Salary-to-revenue ratio	Within 60%	Within 70%	>70%
Current liquidity	Current liquidity ratio >1		Current liquidity ratio <1
Debt load			
Net debt	Within 70% of gross income	Within 100% of gross income	Over 100% of gross income
Leverage degree	Total debt within 70% of equity	Total debt within 100% of equity	Total debt in more than 100% of equity

	Stronger	Midrange	Weaker
Profit level in relation to debt servicing expenditures	No more than 50% of net profit is used for debt servicing	No more than 70% of net profit is used for debt servicing	Over 70% of net profit is used for debt servicing
Sufficiency of cash flows – ability to cover interest payments as well as payments aimed at principal redemption	A free cash flow is sufficient for payment of interest as well as for payments aimed at principal redemption		A free cash flow is not enough for payment of interest and for payments aimed at principal redemption
Ratio of repayment period and asset life	Repayment period does not exceed the asset life	Repayment period is comparable with the asset life	Repayment period exceeds the expected asset life
Business operations			
Stadium utilisation at home matches	>80%	60-80%	<60%
Relations with supporters	No conflicts between shareholders, club management and supporters		Existence of conflicts between shareholders, club management and supporters
Financial fair play of UEFA	Absence of UEFA sanctions/remarks in the area of financial fair play in the previous 3 seasons		Absence of UEFA sanctions/ remarks in the area of financial fair play in the previous 3 seasons
Competitive result	Top-3 in the home championship, and participation in the Champions League group stage	Top-5 in the home championship, and participation in the Europa League group stage	The result is below the 5th place in the home championship and absence of matches in European Cups
Own stadium	Possession of its own stadium not "older" than 10 years	Possession of its own stadium not "older" than 10 years	Renting a stadium

Table 5. Risk assessment of investing in Russian football clubs

	Income and expenses	Business operations	Debt load
Stronger	-	Zenit	-
Midrange	Spartak Zenit	Spartak CSKA Krasnodar	Spartak Zenit Lokomotiv Krasnodar
Weaker	CSKA Lokomotiv Krasnodar	Lokomotiv	CSKA

Source: compiled by the author on the basis of the data of Fitch Ratings, Fitch Solutions, the report A Complex Research of Economics of Russian Football, Season 2018/2019 made by PwC

It should be noted that debt load indicators are controlled individually by UEFA within the 'financial fair play' regulations. In particular, licensing regulations comprise such indicator as debt sustainability – where the relevant debt should not exceed 30 million Euro and the sevenfold mean value of the relevant result in 2 previous periods. The relevant debt is calculated as net debt minus the amount owed, correlated directly to construction, or significant modification of the stadium and/or training facilities since the date of debt incurrence (and up to 25 years after a corresponding asset is declared ready for use). The relevant result for the reporting period is calculated as the sum of the gross income (in accordance with the break-even calculation) and the net result of retirement and purchase of player registrations minus the overall operating expenses (in accordance with the break-even calculation). Additionally, the net debt should not exceed 100% of the gross income.

On the basis of the presented criteria, the credit ratings of Russian football clubs may be articulated. The classic structure of such ratings used by the leading agencies implies over 20 stages: from D (default on obligations) to AAA (the lowest credit risk expectations, an extremely high capability to discharge financial obligations). However, for an accurate evaluation, detailed financial information is necessary which is unavailable to Russian clubs. Patchy data is available concerning certain leading clubs: Spartak, Zenit, CSKA, Lokomotiv, and Krasnodar are examples. Apart from that, there is no data at all on the key subject – the debt load value. Obviously, and unfortunately, none of the clubs concerned can have an investment rating (from BBB-). The main reason for this is low revenue diversification: the lion's share of income goes to sponsors who are often affiliated with the club owners, while the share of income from sale of TV rights is extremely low. The majority of clubs remain loss-making and perform poorly in European Cups. There are also specific problems: Spartak is known for its uneasy relations with shareholders and supporters, while CSKA still experiences serious problems with a large debt load related to the funding of stadium construction. Lokomotiv and Krasnodar encountered problems in the area of financial fair play. Another problem for Lokomotiv is their outdated stadium. For the other 4 clubs modern infrastructure is an advantage. Match attendance and match day revenues of clubs such as Zenit, Spartak, and Krasnodar have grown significantly in recent years, thus reducing the share of the main revenue item – sponsorship agreements. Therein, in accordance with requirements of financial fair play, those agreements were arranged into several agreements, thus reducing (although partially in a technical way) the dependence on one sponsor. On the basis of the existing data the approximate assignment of the five leading clubs of the Russian Premier League to three rating groups is stated (see table 5).

In accordance with the proposed methodology these clubs may be assigned the following ratings:

- Zenit – "BB"
- Spartak – "BB-"
- Krasnodar – "B"
- CSKA – "B"
- Lokomotiv – "B-"

It is important to note that clarification of financial information and data on debt load may significantly influence the final rating.

Calculation of the rate of return which the clubs have to offer to investors is possible on the basis of evaluation of the potential premium of marketable bonds. As an example we use Eurobonds of the Italian club Inter (Bloomberg ticker - INTERM 4 7/8 12/31/22, ISIN - XS1739592142) nominated in Euro with the rating of "BB-".

According to Bloomberg as of April 30, 2019 the bonds were traded with a yield to maturity of 4%. On the basis of market practice we know that the premium of yield for one rating rank comprises on average 20-30 basis points depending on the currency, the issuer's industry, and other factors. Taking into consideration the abovementioned special features of football clubs and the fact that placement has been made in "convertible" currency, we may assume that the premium for 1 rank of the rating may be valued at 25 basis points.

Thus, the fair yield of 4-year Zenit's bonds (rating "BB") nominated in Euro may be considered 3.5%, Spartaks' bonds - 4%, both CSKA's and Krasnodar's (rating "B") – 4.5%, and Lokomotiv's (rating "B-") – 4.75%.

However, Russian clubs have to raise funds in the national currency. First of all, it helps to avoid exposure to foreign currency when the major part of revenues is in rubles and expenses related to the debt servicing are in a foreign currency. Additionally, it is difficult to assess the prospective demand for Eurobonds from foreign investors (actual and potential) in Russian football clubs. At the same time, there are attractive terms for investors in the Russian market and it helps to attract not only supporters of a team, but also classic investors which intend to gain profits in the stock market.

In order to evaluate the rate at which the clubs will be able to raise funds in rubles one can compare swap rates in Euro and rubles. In this case the yield to maturity in rubles should equal the sum of the yield in Euro and the spread between the ruble and Euro swaps for a comparable period (formula 1).

$$R_{rub} = R_{eur} + (r_{rub} - r_{eur}), \quad (1)$$

where:

R_{rub} – borrowing rate in rubles;

R_{eur} – borrowing rate in Euro;

r_{rub} – rate of ruble swaps;

r_{eur} – rate of Euro swaps.

According to figures provided by Bloomberg as of April 30, 2019 the rate of 4-year swaps in Euro amounted to (-0.05%), in roubles – to 8.52%. Inserting this data into the right part of equation (1) and using the figures for

the Euro borrowing rate calculated above for each club, the fair yield of 4-year ruble bonds (the left part of the equation) for Zenit may be assessed at 12.07%, for Spartak – 12.57%, for both CSKA and Krasnodar – 13.07%, and for Lokomotiv – 13.32%.

The most effective and frequently used method of assessment of the prospective required bond yield (depending on the investment period) is based on calculating the premium at which the issuer's bonds are traded. This is calculated with respect to the sovereign bonds curve (in this case - federal bonds with fixed and variable coupon income (OFZ).

According to Bloomberg (as of April 30, 2019) the yield of OFZ series 26225 - with a maturity date in August of 2023 (ISIN – RU000A0JU4L3) amounted to 7.83%, which implies a yield spread of 4-year bonds for the football clubs calculated above from 424 to 549 basis points.

The most popular period of bond placement is from 1 to 5 years duration. For further calculations we assume that the bond yield of the football club for each placement period (1 year, 2 years, 3 years, 4 years, and 5 years) should equal the yield of OFZ with a similar maturity period increased by the spread calculated above.

According to figures provided by Bloomberg as of April 30, 2019 the OFZ with maturity dates in 2020-2024 were traded with the yield of 7.46% to 8.00% (table 6). Thus, the dependence between the maturity of bonds and the possible yield may be represented as follows (table 7).

Thus, taking into consideration all the risks inherent in the sports industry, and in comparison to the credit cost, bonds may be a cheaper instrument. Besides, use of bonds does not result in loss of management. They are characterised by predetermined cost and period, which provides for certainty of financial planning. Additionally, there is no dependence on a particular creditor, and there is an opportunity to manage the debt structure by operations in the secondary market. Apart from the necessity to disclose full information on the club operations, and despite high time, cash, and labour costs, the drawbacks of bond placement comprise compulsory regular payments irrespective of the club performance and a significant increase of financial risk.

In the cases of Spartak, Zenit, and Lokomotiv the bond issuer may be one of their shareholders or sponsors.

Obviously, the rate will be significantly lower, but the terms on which the money will be transferred to the club are also important. For example, sponsorship agreements are of the maximum value and scarcely meet the criteria of financial fair play. Additionally, the bond issuer should disclose the designated use of funds - those conventional investors who are most likely to buy bonds of an entity such as Lukoil are less likely to be as enthusiastic about financing Spartak.

A successful bond placement offers the club great opportunities for further use of financial instruments and has a positive impact on the brand value. However, for the majority of clubs this instrument is unavailable because it requires great cash costs related to placement, a long-term and favourable credit history of the club, and involves meeting the severe financial requirements of investors. Therefore, taking into consideration the purpose of the present paper (the development of recommendations for raising funds by Russian football clubs) special attention should be given to another specific feature of football - that is, the mini-placement of bonds for the club supporters.

The football club Hamburger in autumn of 2012 successfully placed its bonds among supporters for approximately €12.5 million for the construction of a new children and youth school [3]. Another German club, Köln, faced financial difficulties due to its placement in the second division. In order to overcome these challenges, it declared an issue of bonds for €10 million in August of 2012 and offered them to supporters. It was the second case in history when supporters helped Köln to stay afloat by means of buying such bonds (the first case took place in 2005, and in summer of 2011 the club redeemed the bonds).

In recent years this method of financing club activity has increased in popularity. The reason for that, among other things, is the creation of special investment platforms.

For example, the global sports investment company Tifosy, apart from classic sports consultancy services, offers its clients certain fundraising services. The company acts as a financial consultant at all stages of fundraising, and takes on the role of an investment bank when classic bonds are placed [10].

According to Tifosy, in 2018 four European football clubs made use of its services and managed to raise in the region of €10 million (see table 8).

Table 6. Selected data on the yield of OFZ as of 30.04.2019

Period	OFZ series	ISIN	Yield
1 year	26214	RU000A0JTYA5	7.46%
2 years	26205	RU000A0JREQ7	7.65%
3 years	26209	RU000A0JSMA2	7.80%
4 years	26215	RU000A0JU4L3	7.86%
5 years	26227	RU000A1007F4	8.00%

Source: compiled by the author on the basis of Bloomberg data

Table 7. Estimation of the potential level of return on bonds of Russian football clubs, depending on the maturity

Club	Rating	Return	Spread of OFZ	1 year	2 years	3 years	4 years	5 years
Zenit	BB-	12.07%	4.24%	11.70%	11.89%	12.04%	12.10%	12.24%
Spartak	BB	12.57%	4.74%	12.20%	12.39%	12.54%	12.60%	12.74%
Krasnodar	B	13.07%	5.24%	12.70%	12.89%	13.04%	13.10%	13.24%
CSKA	B	13.07%	5.24%	12.70%	12.89%	13.04%	13.10%	13.24%
Lokomotiv	B-	13.32%	5.49%	12.95%	13.14%	13.29%	13.35%	13.49%

Source: compiled by the author

Table 8. Mini-bonds of European football clubs, placed by Tifosy in 2018

Club	Country	Amount	Purpose
Norwich City	England	£3.5 million	Development of the academy
Pescara	Italy	€2.4 million	Development of the training facility
Frosinone	Italy	€1.5 million	Stadium reconstruction
Stevenage	England	£600 thousand	Stadium reconstruction

Source: compiled by the author on the basis of the data provided by the investment company Tifosy

As can be seen above, the English football club Norwich City managed to raise the biggest amount. In March of 2018 it declared the raising of £3.5 million from 740 supporters for the development of a children's sports academy. An investor in that case gets a return of 8% per annum, which consists of 2 parts:

- 5% - monetary payments;
- 3% - club credit, which may be used to buy tickets for matches, food and drinks at the stadium, and other goods and tickets for club events.

If within the bonds maturity period Norwich City manages to get into the English Premier League (EPL), the investors will receive a one-time payment of 25% of the investment amount. Apart from the financial advantage, a supporter-investor gets an opportunity to have his name included on the Wall of Supporters in the club training center.

Thus, mini-bonds are a rather promising financial instrument which affords an opportunity to the club to monetise its relations with supporters. Herewith, it should also be taken into consideration that it is an extremely nonliquid instrument and it does not oblige the club to fulfill normative obligations to the investors related to disclosure of financial information, conducting meetings with management etc.

Share Capital

Apart from debt financing, companies may raise funds by selling a part of their shares or by an additional share issue. Their owners have the right to participate in management of the company and receiving dividends. However, the shareholders of the majority of football clubs want to manage the club on their own and do not intend to disclose information, thus limiting prospects for placement.

The following special types of ordinary shares help to solve this problem:

- non-voting shares – these do not grant the voting right at shareholder meetings;
- subordinated shares – these grant a right to vote, but to a lesser extent than classical ordinary shares;
- low-vote ordinary shares – these grant the right to participate in shareholder meetings only in case of possession of a certain number of shares.

A special feature of preferred shares is the fact that they display all the properties of shares as well as those of bonds. They are recorded on the books as equity capital, however, their owner (as well as the bonds' holder) has a priority right to fixed income in contrast to ordinary shareholders, and usually has no voting right at the shareholder meeting.

There are several types of preferred shares. Cumulative shares imply that in case for some reason the dividends on them are not paid in the current reporting period, their amount is accumulated and the company undertakes to pay them in subsequent years. Noncumulative shares do not offer such an option. Also, preferred shares are divided into shares with a fixed return dividend which remains unchanged within the whole period, and with variable dividend whose value depends on the amount of profit.

Companies may make a private or public placement of their shares. In the case of a private placement a certain part of business is sold to one investor or a limited group.

Table 9. A list of European football clubs whose shares are listed on stock exchanges

Club	Country	Year of IPO	Currency	Raised amount, million	Market capitalization as of 29.03.2019, million
Brøndby	Denmark	1990	DKK	-	240
Celtic	Scotland	1995	GBP	-	154
Copenhagen	Denmark	1995	DKK	-	1 012
Aarhus	Denmark	1995	DKK	-	87
Porto	Portugal	1998	EUR	40	16
Ajax	Holland	1998	EUR	-	312
Lazio	Italy	1998	EUR	61	81
Aalborg	Denmark	1998	DKK	87	35
Sporting	Portugal	1999	EUR	42	48
Roma	Italy	2000	EUR	72	309
Borussia	Germany	2000	EUR	149	751
Juventus	Italy	2001	EUR	143	1 532
Besiktas	Turkey	2002	TRY	19	336
Galatasaray	Turkey	2002	TRY	28	653
Fenerbahce	Turkey	2004	TRY	40	619
Trabzonspor	Turkey	2005	TRY	33	213
AIK	Sweden	2006	SEK	-	59
Benfica	Portugal	2007	EUR	66	60
Lyon	France	2007	EUR	89	170
Ruch	Poland	2008	PLN	5	10
Manchester United	England	2012	USD	234	3 162

Source: compiled by the author on the basis of Bloomberg data, UEFA report Club Licensing Benchmarking Report, Financial Year 2017

The main advantages of this mechanism are the absence of strict legislative and formal requirements, the fact that all material terms of a transaction are defined independently, rather low costs for preparation, rapidity of the transaction, and further opportunities for raising external financing. The drawbacks include a dependence on a limited group of investors and the furnishing to them of detailed information on the company, and the possible inclusion in the board of directors of the investor's representative.

In case of a public placement, the securities are offered to an unlimited number of investors. It may be an initial public offering (IPO) or a secondary public offering (SPO). In practice, an IPO/SPO pursues two main objectives: to raise funds for company development and to capitalise on the achieved results. This instrument is the most complex one of all mentioned thus far, and it requires a very long and diversified preparation. However, at the same time it is the most promising instrument for a modern football club, considering that this "unlimited" group may consist of its supporters motivated by the wish to be a part of the club. Other advantages of this funding source may include an absence of obligatory payments, no requirement to repay the raised funds, and the raising of the profile of the football club which may have a positive effect on the brand value. The main drawbacks include a complex procedure of making the issue, high expenses for its preparation and the necessary public disclosure of information.

The pioneer in raising external financing is the English football club Tottenham Hotspur, which conducted an

IPO back in 1983 placing over 40% of existing shares at the stock exchange. It remained the only public football club for a long time [3].

Subsequently, several dozen European football clubs followed the example of Tottenham, however, for a variety of causes, many of them delisted the shares within a given period. The most relevant example is the delisting of shares of another English club, Arsenal.

In Arsenal's case, in August of 2018, Stan Kroenke, an American entrepreneur, redeemed a 30% portfolio of shares of the club from the Russian billionaire Alisher Usmanov which amounted to £550 million[4]. As a result his share in the share capital exceeded 90% and there arose the obligation to redeem shares from minority shareholders. The total value of the transaction is £600 million, which makes it the largest one in all of football. It is interesting that just £45 million (7%) was paid by Kroenke's own funds. The remaining amount was granted as a credit by Deutsche Bank, which was the American businessman's consultant.

According to the available information as of the end of 2018 there are in circulation shares of 21 European football clubs which belong to the top divisions of their countries (table 9).

For a range of reasons, relations between the football club Manchester United and the stock market deserve close attention. The IPO of 2012 was not the first attempt of the club to go public. Besides, the club managed to raise the maximum amount of funds in the history of football club IPOs and its current market capitalisation substantially exceeds that of its competitors.

Initially the club became public back in 1991, and following an IPO on the London Stock Exchange, it managed to raise over £10 million. However, more than half of existing shares were not sold and the price went down to £2, a fall from £8.33 at the date of offering.

In 2004 club shares started growing due to the purchase of large quantities by the American businessman Malcolm Glazer. He increased his ownership share in the club gradually and by October of 2004 it amounted to 30%. In May of 2005 Glazer reached an agreement with several shareholders concerning the purchase of their share resulting in his ownership of 75% of the club shares. This allowed him to restructure the club into a private company. In order to carry out the transaction, Glazer used debt funding. If before the 'takeover' Manchester United had no debts, by 2006 the indebtedness amounted to £558.9 million.[5] That aroused supporters' indignation and resulted in strained relations between them and club management.

The current period of shares circulation of the football club Manchester United started in 2012 when the club managed to raise $233 million through their IPO. The shares were offered on the New York Stock Exchange, though initially it was planned to do it in Singapore.[6]

In making the IPO, Manchester United placed 166,666,667 "A" shares on offer, each of which grants 1 shareholder vote and which cannot be converted into any other shares. A part of the placed shares (8,333,333 shares) belonged to a selling shareholder and the club obtained no benefit from them. "B" shares, which were not offered under IPO, grant the right to 10 votes and may be converted into "A" shares. After the placement the amount of "A" shares represented 24.2% of the share capital, but their portion of available votes represented only 3.1%. Thus, the club managed to raise funds, while new shareholders gained virtually no influence on the club management.

Manchester United planned to use all the funds raised to repay their debt, that is to redeem and retire bonds. As of June 30, 2012 the club's total debt amounted to £436.9 million. Subsequent to the placement, the debt would have been reduced to £374.3 million. However, due to the fact that the shares had been sold at a lower price, that goal was not attained. Initially the range of the placement price was established as $16 – $20 per share but under the influence of market factors, the offering price amounted just to $14 per share.

Thus, offering shares at a stock exchange helps to get access to the capital of private investors (supporters), but it requires disclosure of information and makes the club value dependent on a range of factors which are hard to predict, and primarily on competitive results. The most important question when shares of a football club are placed is the fair estimation of its value. These issues are addressed in detail in a series of papers by Russian and foreign authors [5, 11, 12, 13]. Taking into consideration the specific character of the Russian football business one is hardly to expect such placements in the foreseeable future. For example, even the most long-expected IPO-that of the Moscow club Spartak - will not take place as its principal shareholder declared, because the club will be transferred to the supporters free of charge[7].

Conclusions

The phase-by-phase public offering of Russian football clubs is one of the key objectives of the Strategy of Football Development in the Russian Federation (Strat-

[4] Phil Serafino, David Hellier. Kroenke to Buy Rest of Arsenal, Ending Tycoons' Soccer Duel // https://www.bloomberg.com/news/articles/2018-08-07/arsenal-owner-kroenke-agrees-to-buy-usmanov-stake-in-soccer-club

[5] Simon Stone. Man Utd: 10 years of the Glazers – is Old Trafford club better off? // BBC. 12 мая 2015. URL: http://www.bbc.com/sport/football/32615111

[6] Fiona Lau, Saeed Azhar. Manchester United plans $1 billion Singapore IPO // Reuters. 16 августа 2011. URL: http://www.reuters.com/article/us-manunited-ipo-idUSTRE77F2BU20110816

[7] https://www.forbes.ru/biznes/378479-fedun-poobeshchal-peredat-stadion-spartaka-bolelshchikam

egy: Football 2020). This indicates that the government realises that when state and local authorities (or government-owned corporations) act as owners and at the same time as sponsors of the majority of clubs, that greatly limits the potential for development of Russian football. Against this background, public share placement seems to be the most promising way to raise funds.

However, the use of this instrument is possible only for the largest Russian clubs which are simultaneously most popular in Europe, most experienced in participation in international competitions, and which have a business model closest to the market model. Examples of such clubs are FC Spartak, FC Zenit, FC Lokomotiv, FC CSKA and FC Krasnodar.

Public share placment is typical for the majority of clubs where there is a range of affiliated legal entities for which a certain part of profits/losses is allocated. At the same time, various agreements for rendering services are concluded between such legal entities.

The Moscow Stock Exchange should be used for IPOs and it can provide opportunities to purchase clubs' shares to a wide range of Russian investors, as well as to foreign investors who have access to trading.

The use of this financial instrument will give Russian clubs a wider access to funds existing in the stock market, allow them to acquire market value, improve brand awareness and the club's image. It will also help to provide conditions for the withdrawal from business of the existing shareholders and get an opportunity for staff recruitment, retention and reward by transferring to them a portion of the available shares. The main drawbacks of this method of raising funds are high time and cash expenditures, potential loss of control over the club, administrative and regulatory confidentiality, and the necessity to meet the requirements as regards the corporate management etc.

For the purpose of diversification of the sources of business funding, the football clubs should consider the opportunity to use debt financing instruments, i.e. placement of bonds. As in the case of IPO and for the same reasons this instrument of financing is potentially available just to a limited number of clubs: FC Spartak, FC Zenit, FC Lokomotiv, FC CSKA and FC Krasnodar.

The most promising method of raising funds for Russian clubs may be the placement of mini-bonds. This instrument is available to every club, since each of them has at least some supporters who are ready to invest in their favourite club. The amount of raised funds, the coupon rate, and other placement parameters in this case are defined by ordinary negotiations between the club and a group of supporters.

Offering of shares/bonds of Russian football clubs to a wide range of investors may substantially increase the level of diversification of funding sources and reduce clubs' dependence on the funds received from public authorities and government-owned corporations. As a result, the clubs will be able to conduct operations as independent business units and the risks that deterioration in the macroeconomic environment in the country will lead to a significant reduction of the budget allocated to the club will fall by the wayside. This latter aspect is the primary problem facing Russian professional football and the examples of Saturn, Tosno, Amkar and Anzhi confirm it.

Entry to the debt market by way of public shares is not just a path towards raising funds, but also an opportunity for clubs to improve the company management structure, to provide insight into the value of the business (*inter alia* for shareholders themselves), and to use the best management practices [7]. This may prove an interesting prospect both for the existing private owners of Russian football clubs, and from the point of view of privatising clubs in general.

The strengthening of the financial standing of Russian clubs will be manifested in a positive way according to competitive results as well- this will result in an upsurge in the interest of all stakeholders in the results of competition: investors, players, coaches and other concerned parties.

The most important positive result may be an improvement in the status of Russian football clubs and a strengthening of their brands. After all, a successful IPO or successful placement of bonds *de facto* means that a certain club has achieved such a stage of development that it is of interest not only to the existing team owners but also to independent investors. This may serve to raise additional funds from new sponsors (including international ones) and hence, it will increase revenues.

Finally, a successful placement of shares or bonds will set a precedent for further, more accomplished co-operation between football clubs and financial markets, because both parties will already have experience which will allow them to maximise the effectiveness of such co-operation.

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Methods of Calculation of Expected Credit Losses Under Requirements of IFRS 9

Alfiya Vasilyeva
PhD Student
ORCID
E-mail: alfiavaf@mail.ru

National Research University Higher School of Economics, Moscow, Russia

Elvina Frolova
PhD Student
ORCID
E-mail: elvinafa@gmail.com

MGIMO University, Moscow, Russia

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Abstract

The most important area of work for financial market regulators including International Accounting Standards Board is to clarify the metrics of credit assessment.

This problem became particularly relevant after the financial crisis of 2008, when the insolvency of approaches to the assessment of credit risks adopted under the then international financial reporting standard IFRS (IAS) 39 became apparent, since credit losses on financial instruments were taken into account by the "loss model", and therefore, the asset was recognized as financially impaired due to the fact of credit quality deterioration and significant time lag. From 1 January 2018 of a new international financial reporting standard IFRS9

IFRS 9 is based on a different approach — the principle of "expected credit losses" (ECL).

The transition to IFRS 9 is intended to strengthen the banking system by increasing reserves , the banking system's stability can be increased also. The new business model radically changes the approach to the formation of reserves, including by taking into account the impact of macroeconomic indicators on their value. According to various estimates, the scale of increase in reserves ranges from 30% to 50%.

The purpose of this article is to systematize the methodological principles and approaches that underlie the requirements of IFRS 9 (basic and simplified and POCI approaches), as well as a comparison of the main methods for assessing the probability of default and expected credit losses (Weibul distribution, migration matrix, generator matrix) In the framework of this article, the authors formulated criteria for the transfer of assets between the stages of credit risk (stage), and also formulated the principles for calculating expected credit risks for each stage, taking into account macroeconomic factors. This article is of practical value, as it can be the basis for the development of methods for calculating the expected credit risks of corporate clients of commercial banks, and can also be used to improve credit risk management models.

Keywords: IFRS 9, expected credit losses, credit risk assessment stages

JEL classification: B40, G21, F65

Introduction

In the previous standard (IFRS 39) the model of actually incurred losses should have been used [1]. It resulted in deferred recognition of credit losses because only the events that have occurred and current conditions influence the credit risk evaluation and the effect of possible future credit losses was not taken into consideration when calculations were made even if they were already expected at the moment [2].

Standard IFRS 9 is intended to solve this problem and is based on the model of expected credit losses [3].

Another change in approaches to credit risk evaluation may be considered recording of forward-looking information on the basis of macroeconomic forecasts (change of inflation, currency rate etc.).

Thus, implementation of this standard is intended to improve the existing approaches to credit risks management.

IFRS 9 contemplates applying of ECL uniform model by using three approaches:

1) general approach used for the majority of credits and debt securities;
2) simplified approach applied to accounts receivable;
3) the approach which will be applied to financial assets which have been credit impaired at initial recognition.

The Fundamental Principles of Creation of Reserves for a Business Portfolio

In order to record financial instruments on the reports under IFRS the Bank creates reserves in the amount necessary to cover the expected credit losses in accordance with IFRS 9. As per IFRS 9 there are three approaches to ECL assessment:

The main approach, based on three credit risk stages:

- First stage – financial instruments which showed no significant increase of credit risk since the first recognition; reserves amount to 12-months' ECL (or for the whole life if it is less than 12 months); the interest return is calculated on the basis of the balance sheet value.
- Second stage – financial instruments which show a significant increase of credit risk but are not impaired ones; reserves amount to ECL for the whole life of an asset; the interest return is calculated on the basis of the balance sheet value.
- Third stage – impaired financial instruments; reserves amount to ECL for the whole life of an asset; the interest return is calculated on the basis of the amortized cost.

Simplified approach – the reserve is assessed as amounting to ECL for the whole life of an asset or in accordance with the principal approach.

Approach for POCI – at first recognition the reserve is not created, an asset is carried at adjusted value after deduction of the impairment effect; the interest return is calculated on the basis of the adjusted effective rate of the amortized cost; subsequent assessment of the reserve amounts to the change of ECL for the whole life.

The date of first recognition usually is understood as the date of signing the contract.

The main approach: credit quality deterioration model

The main approach to calculation consists in a sequential estimate of the credit risk components and further calculation of ECL value. There are four main stages of calculation:

- assignment of financial instruments to a certain Impairment Stage;
- defining the value of the credit risk components PD, LGD, EAD;
- defining ECL value for each Impairment Stage;
- calculation of the reserve amount which corresponds to the aggregative value of ECL for all Impairment Stages:

$$\text{Reserve}=ECL_{Stage1}+ECL_{Stage2}+ECL_{Stage3}, \quad (1)$$

where

ECL_{Stage1} – reserve of financial instruments assigned to Stage 1,

ECL_{Stage2} – reserve of financial instruments assigned to Stage 2,

ECL_{Stage3} – reserve of financial instruments assigned to Stage 3.

According to requirements of IFRS 9 it is necessary to have assessment of ECL for 12 months for financial instruments with no significant increase of credit risk since the first recognition and assessment of ECL for the whole life for financial instruments with a significant increase of credit risk since the first recognition as well as for impaired financial instruments.

Simplified approach

The simplified approach is applied to financial instruments classified as accounts receivable (see the definition in Appendix 1).

The Bank calculates ECL for the whole life of an instrument (including the cases when the life is less than 12 months) for all instruments for which ECL is calculated using the simplified approach except for the cases when the amount of credit requirements is significant in comparison to the portfolio of instruments which belong to accounts receivable. The Bank defines the criteria of significance at its own discretion.

A particular approach to the assets which are purchased or originated credit-impaired at first recognition (POCI).

The expected credit losses of POCI assets are always assessed for the period equal to the life period of the financial instrument.

Table 1. Assigning stages at first recognition

Stage	First recognition
1	In case of absence of impairment indicators
2	-
3	POCI

On subsequent assessment the Bank pursues the following approach:

Table 2. Assigning stages after the initial assessment [4]

Stage transfer		to 1	to 2	to 3
from	1	Absence of a significant increase of credit risk	A significant increase of credit risk	Impairment
	2	Absence of a significant increase of credit risk Restoring (except for POCI)	A significant increase of credit risk persists	Impairment
	3	Restoring (in the absence of criteria of Stage 3 and Stage 2 (except for POCI)	Restoring (in the absence of criteria of Stage 3 and presence of criteria of Stage 2 (except for POCI)	Absence of restoring (criteria of Stage 3 are met) or POCI asset

POCI assets are not transferred to other stages. See the arrangement of defining the impairment stage in Appendix 3.

Table 3. Criteria of transfer to Stage 2

Criteria group	Criteria used in the Bank
Relative change of PD / **rating**	Change of one-year PD (as of the reporting date) / **rating (as of the reporting date)** with respect to a forcast of one-year PD calculated at first recognition (as of the reporting date) / **rating predicted at first recognition (as of the reporting date)**, by factor of N. Threshold values of N are defined by the Bank.
Number of days of delay in payment	Number of days of current delay in payment under a contract is 31 and more, but it does not exceed 90 days

The asset is transferred back to Stage 1 in case of absence of the abovementioned criteria and/or criteria of Stage 3.

At first recognition a reserve for POCI assets is not created. The expected credit losses for the whole life of a financial instrument are recorded by adjusting the effective interest rate.

The amount of the reserve for POCI assets equals to the amount of changes in the losses expected during the whole life of an asset since the date of its first recognition. The expected life of each asset is defined individually.

Defining the Criteria of Transfer from one Stage to Another One

Speaking of the transfer criteria a symmetrical stage transfer logic is applied. It means that as of each reporting date the assets may be assigned both a higher credit risk stage (in case of meeting the criteria confirming a significant increase of credit risk or impairment), and a lower credit risk stage, in comparison with the previous reporting date (in case the criteria of assignment to the 2nd and 3rd stage are no longer met due to improvement of the credit quality).

There are differences in the general approach and the approach for POCI assets at the first and subsequent assessment. Purchased or originated credit-impaired assets at first recognition are assigned to the 3rd stage and are not transferred to other Stages during the period of recognition.

At first recognition the Bank pursues the following approach:

- if an asset is not a credit-impaired one it is assigned to the first stage;
- if an asset is a credit-impaired one at first recognition (POCI) it is assigned to the third stage;
- at first recognition an asset may not be assigned to the second stage.

Criteria of transfer to Stage 2

In order to define an asset with a significant increase of credit risk (quantitative criterion) the Bank compares the default risk as of the reporting date to a corresponding assessment at first recognition (IFRS 9.B5.5.9). The criteria of a significant risk increase are stated in the table below.

Criteria of transfer to Stage 3 (impairment)

The definition of default is harmonized with the definition of credit impairment.

The default of financial instruments pertaining to financial markets operations is a trigger for default of financial instruments of a corporate loan portfolio and vice versa. In practical terms it means that the assets of the 3rd Stage are synchronized regardless of the type of business they pertain to.

Principles of Calculation of the expected credit losses value (ECL)

Calculation of ECL of Stage 1 and 2

The amount of ECL is defined by the following formula:

$$ECL = \sum_{t=1}^{T} MPD_t \cdot LGD \cdot EAD_t \cdot D_t \cdot \\ \cdot MPD_\tau \cdot LGD \cdot EAD_{T+\tau} \cdot D_{T+\tau}, \quad (2)$$

where

MPD – marginal probability of default,

MPD_τ – marginal probability of default of the last (incomplete) period,

LGD – loss given default (under contracts of non-default borrowers),

EAD – exposure at default,

T – for Stage 2: the entier of the remaining life of the financial instrument (in years) since the reporting date; for Stage 1: T=1, if the expected life of the financial instrument exceeds or equals 1 year, T=0, if the expected life of the financial instrument is less than 1 year,

τ - for Stage 2: the fractional part of the remaining life of the financial instrument (in years) since the reporting date; for Stage 1: the expected life of the financial instrument (if it is less than 1 year), τ = 0, if the expected life of the financial instrument exceeds or equals 1 year

D_t – discounting factor.

In case of a non-integral number of years of credit life MPD of the last period is calculated taking into consideration the adjusted conditional PD of the last period. See the formula for adjustment of the conditional PD below.

$$PDm = 1 - (1 - PDy)^{\frac{m}{12}}, \quad (3)$$

where

PDm – the conditional PD for the required period

PDy – one-year conditional PD of a full year

m – the required period (in months)

The cumulative PD is calculated as follows

$$CPD_t = \begin{cases} CPD_{t-1} + (1-CPD_{t-1}) \cdot PD_t, & t>0 \\ 0, & t=0 \end{cases} \quad (4)$$

The marginal PD is calculated as follows:

$$MPD_t = PD_t \cdot (1-CPD_{t-1}) = CPD_t - CPD_{t-1}. \quad (5)$$

Calculation of ECL for Stage 3

The value of ECL (except for the financial instruments for which an individual rate is calculated) is defined using the following formula:

$$ECL = LGD\_def\_t \cdot EAD_{actual}, \quad (6)$$

where

EAD_{actual} – the actual value of credit requirement as of the date of calculation;

LGD_def_t – the expected level of losses in accordance with contracts of defaulted loaners. The expected level of losses (loss given default) is defined depending on the number of years which passed since the beginning of default.

t – number of default years (rounded up to a whole number upwards)

Discounting factor

The discounting factor is calculated as follows:

$$D_t = \frac{1}{(1+r)^{t-0,5}}, \quad (7)$$

where

r – the original effective interest rate,

t – period (year) of calculation of ECL

If ECL is discounted for an incomplete period (see formula 2)

$$D_{T+\tau} = \frac{1}{(1+r)^{\left(T+\frac{\tau}{2}\right)}}, \quad (8)$$

where

r – the original effective interest rate,

T– the entire of the remaining life when calculating ECL

τ- the fractional part of the remaining life when calculating ECL

Adjustment of the period at discounting (t-0.5) means that discounting takes place as of the middle of the period (year). It is equivalent to the assumption that cash flows arrive evenly within the year and are not displaced to the beginning or end of the period.

Taking into Consideration Forecasting Information and Number of Macroeconomic Scenarios

In accordance with art. 5.5.17 (c) of IFRS 9 in order to assess ECL value it is necessary to use, among other

things, the information on anticipated future economic conditions available as of the reporting date not entailing excessive cost or efforts. The approach applied to taking into consideration the anticipated information should take cognizance of the following principles:

- accord of the found statistical dependence with economic rationale;
- justification of applied assumptions;
- coherence (consistency) of the anticipated information;
- use of several external (for example, the forecast of the Ministry of Economic Development of the Russian Federation) and internal (the Bank forecast) data sources.

In accordance with IFRS 9 5.5.18 and B5.5.42 an organization should assess ECL on the basis of at least two scenarios [5]: "the probability of credit loss and the probability of absence of credit loss" the results of which have been weighted against the probability of occurrence of each of the scenarios.

The anticipated macroeconomic information may be included in the assessment at ECL level or at the level of individual components (PD, LGD, EAD).

When taking into consideration the macroeconomic information at the level of individual components the following approach is applied to adjustment:

- the values used to assess the probability of default for the whole life of the financial instrument: PDt, MPDt, CPD(t) (the frame within which taking into consideration of the anticipated information is applicable is defined depending on the forecast accuracy) (see Appendix 2) are adjusted;
- in case of materiality of influence of macroeconomic factors LGD is adjusted (materiality is evaluated by experts. The expert assessment may be based on the analysis carried out to find a dependence or on a consolidated opinion of experts involved in LGD modeling);
- in case of materiality of influence of macroeconomic factors EAD is adjusted (materiality is evaluated by experts. The expert assessment may be based on the analysis carried out to find a dependence or on a consolidated opinion of experts involved in EAD modeling).

Concept of Calculation of Statistical Assessment of Credit Risk Components and ECL Value

The model calibration as per IFRS 9 [5] is made in accordance with the principle of "PIT, at a point in time":

$$PD_t^{PIT} = \beta_t \cdot PD_t^{TTC}, \quad (9)$$

where

PD_t^{PIT} – the probability of default on the basis of PIT calibration;

PD_t^{TTC} – the probability of default on the basis of TTC calibration;

β_t – the scaling factor defined on the basis of data on the current degree of the portfolio default

The following methods are used to assess PD:

- use of external data on defaults;
- methods based on the migration matrix;
- methods based on approximation of historical default rates;
- the approach based on extrapolation by the exponential curve method (simplified approach).

The method based on use of external data on defaults evaluates PD on the basis of migration of ratings information on which is offered by external rating agencies (S&P, Moody's, Fitch Ratings). If the Bank has no statistics to build a migration matrix using internal data the migration matrix built on the basis of external data is used. Depending on the purpose of modeling statistics of one or several rating agencies may be used. In case of inversions in the data of external matrices the matrix is adjusted (by experts or applying mathematical methods of function reduction to a monotone function).

PD assessment on the basis of migration matrices. The migration matrix is a square matrix which components contain the probability of change (probability of transfer) of the rating category of a corresponding Borrower.

$$M = \begin{bmatrix} p_{11} & \cdots & p_{1,n} \\ \cdots & \cdots & \cdots \\ p_{n-1,1} & \cdots & p_{n-1,n} \\ 0 & 0 & 1 \end{bmatrix}, \quad (10)$$

where

p_{ij} – probability of transfer to the rating category j in a certain time period provided it belongs to the rating category i.

In order to build the migration matrix the Bank uses a rating scale of internal credit ratings.

The Bank does not set the lower an upper limits of values for the default probability. In accordance with IFRS 9 the evaluation of default probability is unbiased. Consequently, the conservatism concept enshrined in the assessment model of default probability in accordance with IRB of Basel II cannot be used to calculate PD in accordance with IFRS 9 and when IRB of PD-models is brought into conformity with requirements of IFRS 9 such material adjustments are excluded (inter alia, the adjustment of "PD not less than 0.03%" established in accordance with Regulation 483-P is excluded) [6].

This is with the exception of the adjustment for the rating of the Russian Federation (the borrower's rating is not better than the rating of the Russian Federation): this adjustment remains unchanged.

Depending on availability of data when building the migration matrix consolidated (for example, consolida-

tion of ratings 7-, 7, 7+ into one category) or initial rating categories may be used.

Estimation of probabilities of transfer is defined by the cohort analysis:

$$\widehat{p_{ij}}=\frac{N_{ij}(t)}{N_i(t\text{-}1)}, \quad (11)$$

where

$N_{ij}(t)$ – number of migrations from state I into state j within the period of t,

$N_i(t\text{-}1)$ – number of transactions in the state of I within the period of t-1.

Default probability over the horizon of 1 year

One-year migration matrix M_0 is built on the basis of observations statistics for 12 calendar months. In order to take into consideration the most up-to-date information smaller periods may be used.

A medium one-year migration matrix is calculated by finding the arithmetic mean of one-year migration matrices obtained on a quarterly (monthly) basis.

The one-year probability of default (PD_t) for each rating category is defined as the probability of transfer into the state of "10-default". In the migration matrix (PD_t) is stated in the last column of the yearly matrix of transfers.

If the statistical frequency of defaults contravenes the probability of default in each rating grade of the Bank mater-scale scaling is performed. The adjustments are recorded in the Model Development Report.

Probability of Default within the Life of a Financial Instrument

When evaluating PD value on the basis of migration matrices the following principal assumptions are proposed:

future transfers into rating grades depend only on the current rating but not on previous ratings (Markov process feature);

probabilities of migration do not depend on a certain timepoint, i.e. the speeds of transfer do not change over time (homogeneity).

Formula to calculate the probability of default within the life of a financial instrument:

$$M_T=M_1^{\,T}, \quad (12)$$

where T – life of the financial instrument

The column in the multiyear matrix which shows the probability of transfer in the state of default is the cumulative probability of default in a corresponding period (cPD). Use of the migration matrix helps to take into account the full information on migration of ratings when calculating the probability of default for the whole life.

Assessment of the survival function parameters

Profiles of cumulative PDs are built by evaluation of distribution parameters of cumulative DR.

On the basis of Weilbull distribution [7]:

Parameters of Weilbull distribution k and λ are evaluated on the basis of a linear regression of the double logarithm of the survival function. The survivorship function is defined by the following formula:

$$S(t):=1\text{-}F(t;k,\lambda), \quad (13)$$

where $F(t;\kappa,\lambda)$ – a two-parameter Weibull distribution function.

$$F(t;\kappa,\lambda)=cDR(t;\kappa,\lambda)=\begin{cases}1\text{-}e^{-\left(\frac{t}{\lambda}\right)^k}, & t>0\\ 0, & t\le 0\end{cases}, \quad (14)$$

where $k > 0$ defines the shape of the distribution function. $k < 1$ indicates recession of default in course of time, $k = 1$ indicates stability of default over time, $k > 1$ indicates increase of default in course of time;

$\lambda > 0$ – scale parameter, regulates the survival time.

On the basis of Weilbull modified distribution:

Cumulative PD are modeled by choosing the distribution parameters which describe the behaviour of cumulative default rates most accurately. The two-parameter Weibull modified distribution function is presented as follows:

$$F(t,\alpha,\beta)=cDR(t,\alpha,\beta)=\begin{cases}\dfrac{1\text{-}e^{-\left(e^{-(\alpha\cdot t^{\beta})}\right)}}{\left(1\text{-}e^{-1}\right)}, & t>0\\ 0, & t\le 0\end{cases}, \quad (15)$$

where

α and $\beta < 0$ –parameters of Weibull modified distribution,

$cDR(t,\alpha,\beta)$ – cumulative default rate in the t year.

Simplified approach: PD assessment on the basis of extrapolation by the exponential curve method

This approach suggests convergence of conditioned TTC of PD profiles in a certain year of life in the central tendency point. Evaluation of multiyear PD on the basis of the Simplified Approach consists in modeling of conditioned PD for the whole life and is based on an expert or empiric assessment of two parameters:

- convergence point of PD profiles;
- convergence speed of PD profiles.

The principal stages of obtaining marginal PIT of multiyear PD are presented below:

- defining the parameters: convergence point and convergence speed;
- building of multiyear conditioned TTC of PD profiles on the basis of parameters and TTC of PD for 12 months;
- PIT calibration of conditioned TTC of PD profiles for the first two years of life;

- obtaining of multiyear marginal and cumulative PIT of PD profiles by means of ECL conditioned for calculation and assignment to the credit risk stages.

Figure 1 shows the approach which describes parameters for building of conditioned PD profiles.

CT is defined as medium empirical default rate, the convergence speed is defined by experts and depends on the average life of a loan and modeling level.

When applying the approach to PD assessment on the basis of extrapolation by the exponential curve method it is possible, for example, to use the following formula (other ways to describe exponential curves of conditioned PD levels are possible):

$$PD(t)=\exp(\ln(PD(t-1))(1-\frac{t-1}{T})+\ln(CT)\frac{t-1}{T}), \quad (16)$$

where

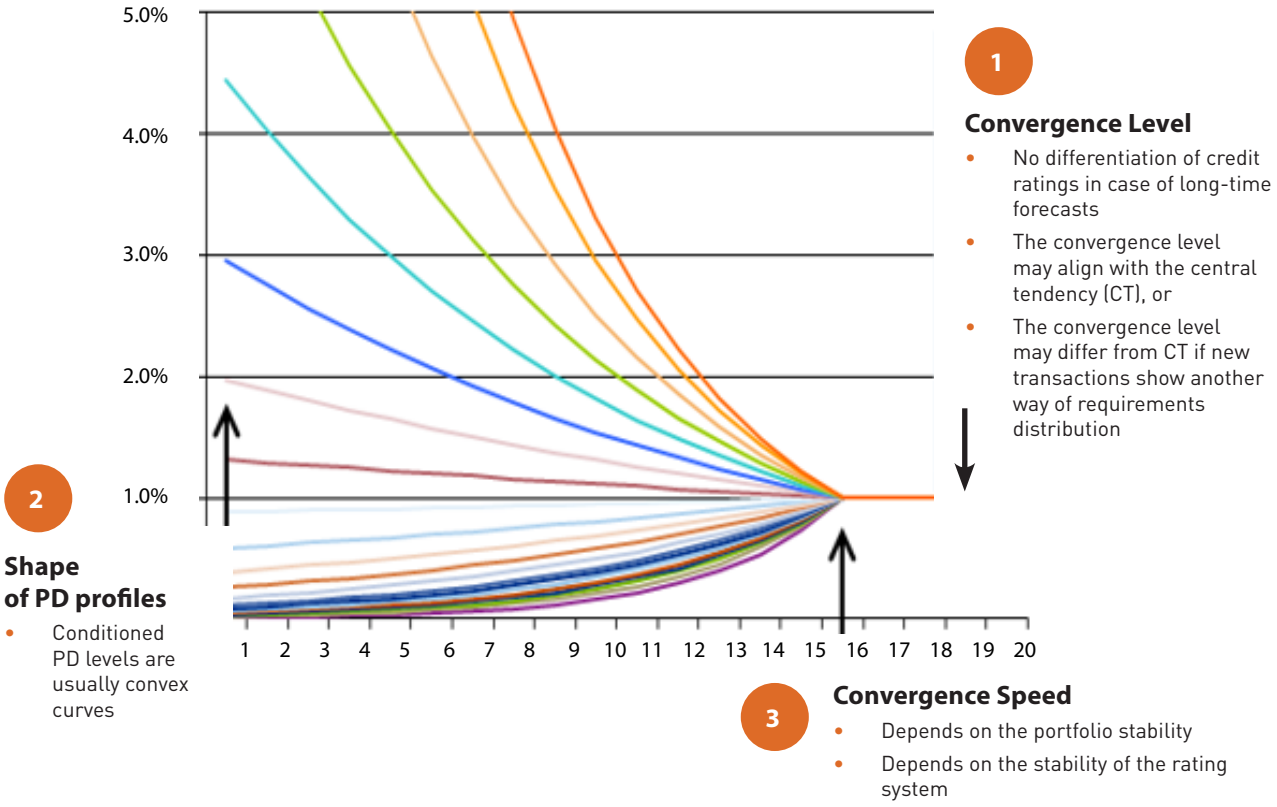
CT – central tendency,

T – convergence time,

t – assessment period, in years, t>1.

An example of PD calculation in accordance with the simplified approach is introduced in Appendix 4.

Figure 1. Conditioned PD profiles on the basis of the simplified (parameter-oriented) approach



Conclusion

Implementation of IFRS 9 requires change of traditional banking approaches and improvement of the existing methodologies and models of credit risk assessment including the cases of calculation of expected credit losses. In accordance with IFRS 9 there exist three approaches to ECL assessment:

The principal approach based on three stages of credit risk:

The simplified approach – the reserve is assessed in the amount of ECL for the whole life of an asset or in accordance with another approach.

Approach for POCI – at first recognition the reserve is not created, an asset is carried at adjusted value after deduction of the impairment effect; the interest return is calculated on the basis of the adjusted effective rate of the amortized cost; subsequent assessment of the reserve amounts to the change of ECL for the whole life.

The date of first recognition is usually understood as the date of signing the contract.

The present research has developed methodological principles and offered solutions applicable in bank practices (introduced criteria of defining transfer of assets from stage to stage, evaluated PD on the basis of extrapolation by the exponential curve method as per the simplified approach).

We also conducted a comparative assessment of various models of PD lifetime assessment (Appendix 4).

- Weilbull distribution: may be applied instead of migration matrices if corrections in the master scale are not necessary and use of the generator matrix decreases the number of corrections introduced in an expert way/manually
- Migration matrices: applied if data on defaults is insufficient (for applying Weilbull distribution)
- Generator matrix: may be used instead of migration matrices if corrections in the master scale are not necessary and use of the generator matrix decreases the number of corrections introduced in an expert way/manually.

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Appendix 1: PIT-calibration

One of the principal requirements of the new Standard is evaluation of ECL at a point in time (PIT) [1] which implies use of historic record, information available for the time being, as well as forecasting information (macroeconomic factors). TTC of PD represents an average PD over the whole economic cycle, the assessment of this PD is based on all available information about the borrower.

TTC of PD is stable in time and has no correlation with the economic cycle.

PIT calibration may be obtained from the traditional long-term cyclic assessment (TTC) as shown in the figure below.

PIT calibration should comprise macroeconomic information.

PIT calibration is conducted applying one of the four methods described below.

Linear scaling

The method is based on the ratio of the portfolio default rate and portfolio PD:

$$PD_t^{PIT} = \beta_t^{PIT} \cdot PD_{i,t}, \quad (17)$$

where $\beta_t^{PIT} = \frac{DR_t}{Portfolio\_PD_t}$

The main restriction of this approach is unlimitedness of the line function due to which PD may go beyond the limits [0:100%].

Bayesian approach [8]

PIT calibration is conducted on the basis of Bayesian formula where PD of a contract/client/risk of a category is scaled in accordance with default rate and portfolio PD.

$$PD_{i,t}^{scaled}(AP) = \frac{[1-Portfolio\_PD_t] \cdot AP \cdot PD_{i,t}}{Portfolio\_PD_t \cdot [1-DR_t] \cdot [1-PD_{i,t}] + [1-Portfolio\_PD_t] \cdot DR_t \cdot PD_{i,t}}, \quad (18)$$

where $Portfolio\_PD_t$ – TTC of portfolio PD as of the reporting date t,

$PD_{i,t}$ – PD for 12 months of risk category i,

AP – anchor point.

Anchor point approach

PIT calibration is conducted on the basis of the current default rate of the portfolio using the following formula:

$$PD_{i,t}^{scaled} = \frac{1}{1+e^{-(\mu+\beta \cdot Score_j)}}, \quad (19)$$

where parameters μ and β are calculated as follows:

- the average PD value for the clients from the selection used for the calibration is equated with the central tendency value.
- the parameters are calculated by minimizing the difference between the anchor point (AP) and the average model value of PD in the whole selection.

Vasicek formula [9]

In order to scale TTC of PD in PIT of PD function Z is used which predicts the default rate.

$$PD_{t,i}^{PIT} = N\left(\frac{N^{-1}\left(PD_{t,i}^{TTC}\right) - \sqrt{\rho}\, Z}{\sqrt{1-\rho}}\right), \quad (20)$$

where

$N()$ – standard normal distribution,

$N^{-1}()$ – inverse normal distribution,

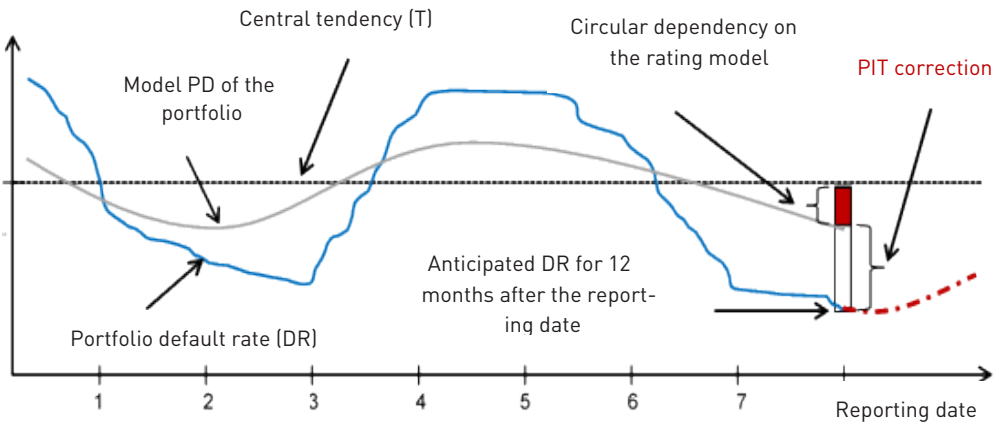
ρ – parameter of influence of a macroeconomic factor calculated by the least square method using the reduced gradient algorithm,

$PD_{t,i}^{PIT}$ – PD calibrated at a point in time,

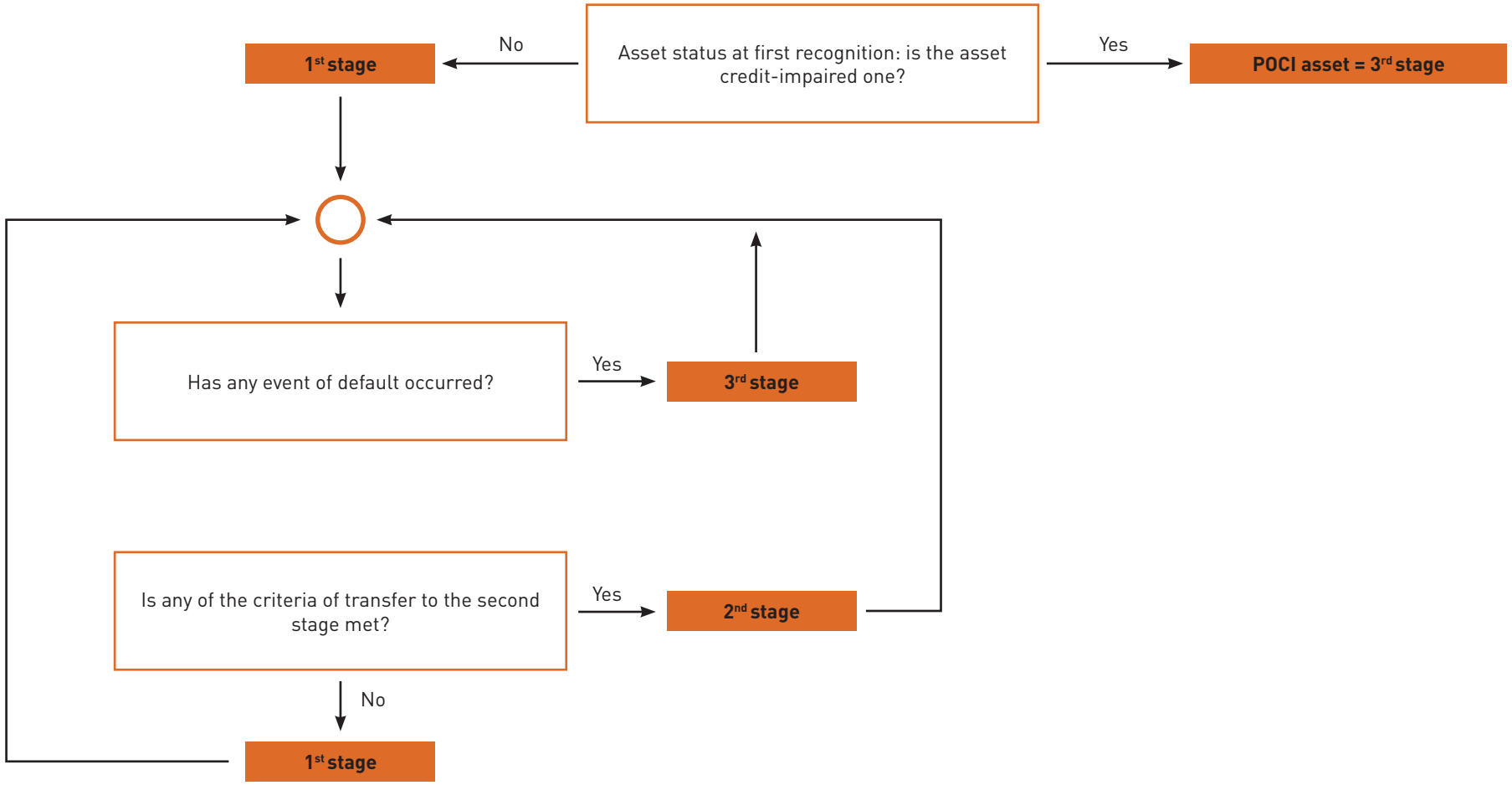
$PD_{t,i}^{TTC}$ – PD calibrated "with reference to cycle",

Z – standardized function of a macroeconomic factor/factors.

Figure 2. PIT calibration process



Appendix 2: Defining the impairment stage

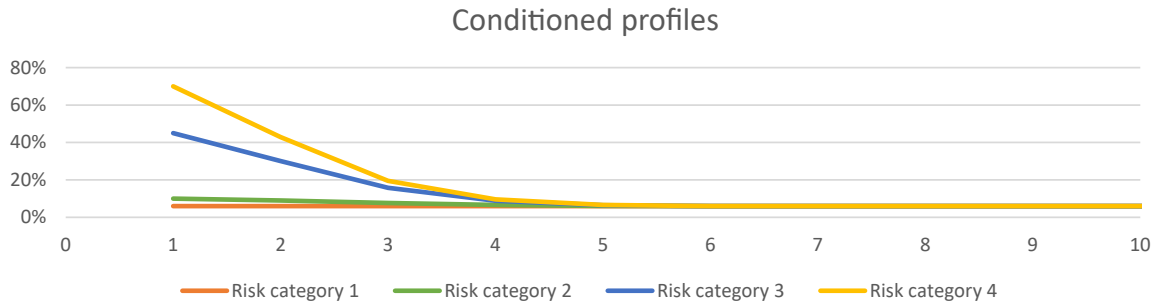


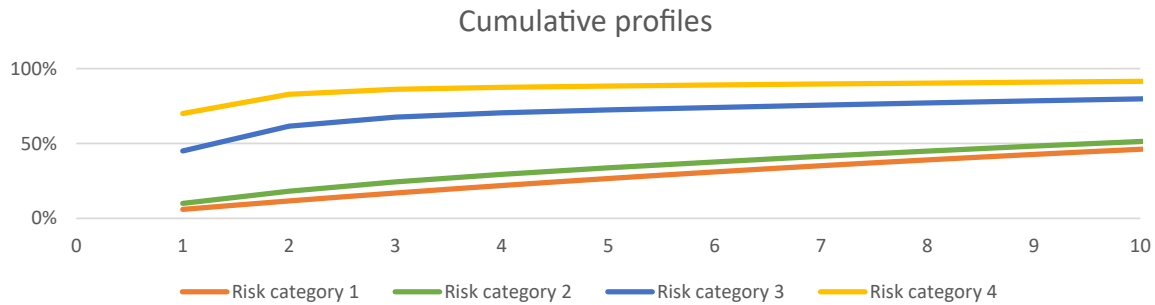
As of each reporting date comparison to the asset status at first recognition is made.

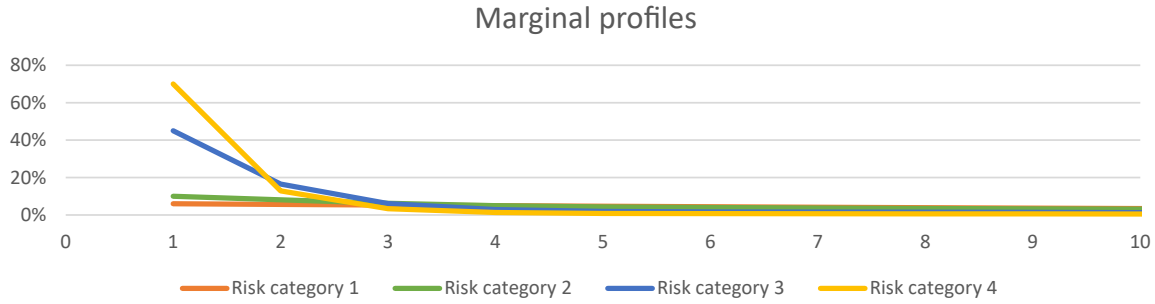
Appendix 3: Justification of the chosen pd modeling approaches

Method	Advantages	Drawbacks	When to be applied?
Weilbull distribution	The model approximates model DR much better to the observed DR that migration matrices do it Simplicity of use	Requires a lot of data on defaults	Applied in case of **a large amount of data on defaults (for DR building for several years)**
Migration matrices	Uses more intensively the existing information on the segment and for this reason may be built with a smaller number of defaults Existence of a convenient mathematical apparatus Possibility of introducing adjustments (for example, at master scale)	at long time intervals (more than 9 years) it exaggerates the result significantly – may be disregarded on account of discounting	Applied in case of **insufficient data on defaults (for use of Weilbull distribution)**
Generator matrix	Uses more intensively the existing information on the segment and for this reason may be built with a smaller number of defaults Existence of a convenient mathematical apparatus Existence of convenient mathematical methods of introducing adjustments Possibility to get assessments of PD for nondiscrete time intervals Possibility to get nonzero PD with high ratings even in case of absence of observed defaults	High complexity of use Absence of an intuitive explanation when introducing corrections in the master scale At long time intervals (more than 9 years) it exaggerates the result significantly – may be disregarded on account of discounting	May be applied **instead of migration matrices**, if: Corrections **at master scale** are **not required** and Application of the generator matrix **decreases the number of corrections** introduced in the expert way/manually

Appendix 4: Example of calculation of PD in accordance with the simplified approach to PD calculation







Literature Review of Mergers and Acquisitions with the Aim to Obtain Technology and Knowledge

Elena Ochirova
PhD Student
ORCID
E-mail: eochirova@hse.ru

School of Finance, National Research University Higher School of Economics, Moscow, Russia

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Literature Review of Mergers and Acquisitions with the Aim to Obtain Technology and Knowledge

Abstract

Technological transformation of the economy is pushing companies to create or improve their technological capabilities. One of the ways to acquire technology and knowledge that allows companies to remain competitive is mergers and acquisitions (M&A). The efficiency and motives of M&A transactions with motivation of obtaining new technology and knowledge are the subject of a large number of studies. The contradictory results of studies of technological M&A transactions can be explained by the gaps of the empirical analysis or the weakness of the theoretical knowledge. The purpose of this study is to review the theoretical works on the effectiveness of M&A transactions in order to acquire technology and knowledge, and to identify the main results in this area. In particular, the motives of technological M&A deals were identified; the technological overlap of the parties of the M&A transactions and the relationship between the intensity of R&D expenses, innovative activity and company efficiency were described. In order to identify the relevant key determinants of the effectiveness of technological M&A transactions the motives of traditional M&A transactions were also examined. As a result of the analysis, it was revealed that the technological similarity between the acquiring and acquired companies have positive effect on the reaction of investors and on the effectiveness of the transaction, however, it negatively affects the overall effectiveness of the buyer company. The intensity of R&D expenses and innovative activity demonstrate inconsistent results on companies' performance. Factors that have direct or indirect impact on the integration between companies - have contradictory results on both parties of a deal. Based on the existed literature the effectiveness of M&A transactions with the aim of acquiring technology and knowledge is associated with uncertainty for investors caused by the risks of such transactions in different sectors of the economy, the motives of managers and the characteristics of the parties of the transactions.

Keywords: mergers and acquisitions, innovation, efficiency of mergers and acquisitions

JEL classification: G34, O32

Introduction

Under modern rapidly changing conditions technological development increases influence on various economy sectors [1-3] and plays a significant part in improving competitiveness, productivity and, in general, in successful performance of companies. Many companies have to develop new business models, adapt to technological changes, implement actively technologies into production and develop their potential of technological capabilities [4]. However, some companies face difficulties when they create their own innovative technologies because they have no necessary knowledge and skills [5-6]. One of the ways of acquiring technological knowledge and developments which are beyond their powers is mergers and acquisitions (M&A) [7-9]. M&A deals may be a part of the strategy of company development and efficiency improvement [10-12]. Apart from that, it is presumed in scientific literature that increasing complexity of technologies is one of the main determinants of mergers and acquisitions waves [13-14]. According to R. Frey and K. Hussinger [15] due to mergers and acquisitions companies may reorganize effectively their own technologies and to improve significantly their technology expertise. So, the question arises: what the degree of effectiveness of mergers and acquisitions in order to acquire technologies and knowledge is for financial indicators of a company and what their main determinants are.

In general, M&A may bring about various results for the parties of a deal [16]. Some researches in the field of mergers and acquisitions showed destruction of value of the acquiring company while others found a positive excessive yield or a zero yield [17-18]. Researchers assert that the mixed influence on company shares' profitability is caused by the fact that investors, depending on specifics of transactions, evaluate expectations in regard to the transaction synergistic effect differently [19]. For example, P. Asquith [20], found out that acquiring companies from the list of Fortune 1000 within 1963-1979 got a significant excessive profitability [+2,8%] from transactions within the events window [-20, 0]. E. Berkovitch and M. P. Narayanan [21] assumed that the reason for the positive yield of M&A deals was the synergy motives when managers of the target and acquiring companies took part in the deal only if it maximized the welfare of shareholders of both parties. In scientific papers on mergers and acquisitions operating and financial synergy is distinguished, the first one is intended to improve efficiency of the acquiring company due to the capacity and scope effect while the second synergy is aimed at decrease of investment costs due to reduction of investment risk [22-23]. If the acquired company has been overestimated and its intangible assets lose in value in course of time it may cause negative results for the acquiring company. The other reason for difference in results for M&A deals may be the time interval of evaluating the deal effects. As a rule, investors of the acquiring company get an excess profitability in the short term or in a smaller event window, for example, [-1, 0] or [-1, 1] [11]. T. Loughran and A. Vijh [24] found out that although in general investors of acquired companies got a high excess profitability in the immediate future, at a longer period such profitability became insignificant. R.J. Rosen [25] discovered that in case of a low activity in the M&A market the acquiring companies had a high profitability in the short term, while in the long term the profitability of the buying company declined. Efficiency of the companies' integration may also be attributed to corporate and cultural differences [26].

Motivation of M&A Deals Aimed at Purchase of Technologies and Knowledge

Motivation of M&A deals in order to purchase technologies and knowledge may be highly specific for various economy sectors. S. Ma and Z. Liu [27] distinguished several motives of M&A deals for the purpose of purchasing technologies and knowledge: expansion to a new market segment or diversification; sophistication of a company's technology; possibility of growth of the acquiring company when a large buyer, instead of investments into its own research and development (R&D), preferred to purchase advancements in technology from a relatively small acquired company. According to Y. Konchitchki and D.E. O'Leary [28] the key motive for implementation of advanced technologies by the companies is attaining a technological competitive advantage. The authors found out that companies got a significant excess profitability when they announced implementation of various information technologies or related information systems in the company operations which indicated a positive investors' response. Generally, the literature dedicated to M&A deals intended to purchase technologies and knowledge is indicative of the positive excess profitability for the acquired, as well as for the acquiring company [29-31]. N. Kohers and T. Kohers [30] studied short-term results of M&A deals of American high-tech companies and found out a significant positive effect irrespective of the manner of payment: by money transfers or shares. In the research dedicated to study of the effects of purchase of technologies the authors G. Benou and J. Madura [29] also discovered a positive market response. A. Deshmukh [32] studied M&A deals in the field of information technologies, software and Internet where the average excess profitability on the day of announcement amounted to + 1.23%. However, science-based and innovative sectors which also comprise IT depend much more on certain skills and experience and, consequently, they may face management problems as a result of M&A [33]. Thus, one may come to the conclusion that the stock market response to announcements about mergers and acquisitions of technology companies is related to the investors' uncertainty as regards the fair value of shares whether they are representatives of the acquiring company, or the acquired company.

In addition to the above, the motivation to implementation of technologies may also be the companies' desire to cut down expenses, increase sales and attain operating efficiency. M&A deals are more successful if the buyer company and the target company have technological similarities as long as it facilitates overcoming a significant informational asymmetry [34-35]. If the implemented technology is in line with the company's business and implies improvement of its operating efficiency the positive market response is anticipated. Successful results of a M&A deal depend on the degree to which internal research and development of the acquiring company correspond to the purchased technologies and knowledge [3]. Existence of corresponding internal research and development in possession of the acquiring company is one of the key preconditions of effectiveness of an M&A deal because it helps to gain the knowledge of the acquired company in a better way.

Technological similarity of the parties of an M&A deal results in operating reorganization of the merged company. According to V. Maksimovic [36] within the first 3 years after acquisition duplicates of developments are replaced, research laboratories are united. This results in shutdown and sale of 18% and 27% of factories of the acquired company respectively. After M&A deals of technologically similar companies a greater number of employee termination is observed [37]. M. Colombo and L. Rabbiosi [38] found out that termination of staff did not bring about increase in productivity of R&D while replacement of senior executives of the merged company could improve this figure. Thus, M&A in order to purchase technological capabilities of the target company aiming at operating synergy depend on the degree of technological similarity of companies. Existence of similarities in the technological development of the companies involved in M&A has a positive influence on investors' response as well as on the deal efficiency, but the excessive number of duplicate research and development affects the total efficiency of the buyer company.

Determinants of M&A Deals Efficiency Aimed at Purchase of Technology and Knowledge

M&A deals in order to purchase technologies and knowledge become an intrinsic part of research papers on M&A in general [39-40]. A series of studies is focused on the interrelation between the rate of R&D expenditures and companies' efficiency [41]. D.R. King [41] found out that target companies with a significant amount of R&D investments in comparison to the companies with low expenditures for research and development create a higher excess profitability for the buyer companies. However, in accordance with the research by G. Ahuja and R. Katila [42] if the target company has a larger number of its own developments in comparison to the acquiring company the efficiency of such deal is lower because in this case the buyer company experiences difficulties in gaining new knowledge and applying it for commercial purposes. Influence of M&A deals on the innovative activity intensiveness of a company is controversial [43]. According to V. Baesu [44] there is a positive correlation between the number of employees involved in R&D and innovations. Besides, the authors found out that high R&D costs result in decrease of the company innovative activity which in its turn may be indicative of poor expenditure effectiveness. However, such results may be evidence of the unique character of the developed product. Companies focus on carrying out of individual ideas and their innovative activity is hinged on one specific field. A series of studies indicates that, as a rule, buyers are the companies with a significant number of patents and rather low R&D expenditures [45]. According to F. Szücs [46] the acquiring company makes its choice on a case-by-case basis mainly taking over the companies with high R&D expenses. Besides, the author revealed the regularity of R&D investment quote and found out that within 5 years after the purchase the target company as well as the buyer company had decreased R&D costs and intensiveness, then the indicators came back to their normal value. M.A. Hitt [4] discovered that M&A deals adversely affected R&D investments and efficiency of buyer companies.

It is of importance that effects of various developed or purchased technologies vary considerably [47]. According to F.M. Scherer and D. Harhoff [48] approximately 10% of created and patented innovations may account for 93% of all subsequent positive financial results. Often in the studies the values of the rate of R&D expenditures and its variations serve as a guidemark for defining the existing companies' fund of knowledge while quantitative and qualitative evaluation of patents may be construed as a result of operations, i.e. the innovative activity. The relation between these two indicators is sometimes ambiguous and this is reflected on empiric results of researches.

The literature also pays attention to defining determinant characteristics involved in M&A of the companies which influence the efficiency of mergers and acquisitions in order to purchase technologies and knowledge [49]. The research by G.Benou and J. Madura [29] showed that the acquiring company's previous experience of M&A deals and the transaction value had positive effect on excess profitability while R&D expenditures adversely affected the profitability. Similarly, P. Porrini [50] studied transactions of high-tech companies and found out that previous M&A experience brought about positive results for the buyer company and negative results – for the target company. The buyer company's experience in M&A deals may be a positive sign for investors, i.e. it is indicative of a possible, relatively high speed of integration of the acquired company. The opposite results for the target company probably show significance for investors of the risk of management's opportunist behavior. Against the background of intensive competition, the previous experience in M&A for the acquiring company may play a crucial part in M&A deals in order to purchase technologies and

knowledge because it facilitates quick commercialization of the purchased technologies and accelerated integration in organization.

There is a large number of researches of efficiency of cross-border and local M&A transactions [51-52]. According to A. Boateng [53] cross-border M&A are often the deals in order to purchase technologies and knowledge protected by patents. Some technologies are developed and patented only for the domestic market. Under such conditions other efficient ways of gaining knowledge, apart from purchase of a company together with technologies, do not exist. Studies of efficiency of international and local mergers and acquisitions in tech-intensive sectors show that cross-border deals are more efficient than local ones [54]. It was proved that in case the acquiring and the target company belonged to tech-intensive sectors the excess profitability in international transactions was much higher than in local ones [55-56]. The research by J. Hagedoorn and G. Duysters [57] on average cross-border M&A deals shows a higher technological efficiency. Francoeur [58] makes a point that R&D expenses of the acquiring company are an important factor in achieving an excess profitability in international M&A deals. Besides, the technological development level of the country where the buyer and target companies operate influences the efficiency, and this is related to availability of opportunities for a successful commercialization of purchased technologies [59].

Proceeding from the type of integration of the merging companies horizontal, vertical and conglomerate M&A deals are usually distinguished [27]. Horizontal mergers and acquisitions take place between competitors of the same industry and it implies that technologies of such companies should be similar. In case of such integration the company mainly experiences the operational synergy effect. In its turn, the vertical integration occurs when a company mergers with a supplier or buyer of its products. Such mergers and acquisitions may generate additional value provided the company has assets of narrow specialization. In this case the vertical integration provides for a better coordination when using complementary, highly specialized resources at all stages of the production cycle [60]. Conglomerate mergers and acquisitions are aimed at diversification of operations and products of the buyer company. According to J. Hagedoorn and G. Duysters [57] only vertical and horizontal mergers may be called technologically congruous while conglomerate mergers take place among the companies which have no technological relation. Apart from that, the authors found out that horizontal and vertical M&A deals made by the companies which invest actively in research and development upgrade their common technological capabilities. On the other hand, the authors show that such companies have a good chance for duplicate R&D due to a similar knowledge base which results in lesser opportunities for the acquiring company to develop entirely new technologies. Colombo and Rabbiosi [38] analyzed horizontal mergers and acquisitions and found out that technological similarity of two companies results in negative innovation indicators of the merged company.

The issue of efficiency of high-technology transactions over the long term is still insufficiently studied. S. Dutta and V. Kumar [18] discovered a positive influence of M&A when analyzing cash flows adjusted in accordance with the industry specifics before and after purchase. The authors found out that purchase of high-tech companies does not result in a significant degradation of the buyer's long-term operational indicators. However, R.P. Rau and T.Vermaelen [62] came to the conclusion that in the long term the evaluation of the purchased company is adjusted because if in the short term the transaction has been overestimated, in the long term the shares' value will come down.

Conclusion

Thus, the results of the research papers dedicated to M&A deals in order to purchase technologies and knowledge are mixed in a series of research lines related to the motives which predetermine the actions of managers and the company characteristics. The considered aspects of M&A deals in order to purchase technologies and knowledge comprise the main fields of scientific research in this sphere.

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Effect of Behavioral Strategy on the Financial Stability of Insurers in the Russian Market Environment

Lyudmila Tsvetkova
Candidate of Economic Sciences, Associate Professor
ORCID
E-mail: l.tsvetkova@inno.mgimo.ru

Department of Risk Management and Insurance, MGIMO University, Moscow, Russia

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Effect of Behavioral Strategy on the Financial Stability of Insurers in the Russian Market Environment

Abstract

When moving towards business goals, the insurance company is forced to consider the diverse interests of various stakeholders, who resemble a some kind of informal coalition. The stakeholder relationships may vary and be other than cooperative, with conflicting interests, and even competitive. However, all parties with an interest should be considered as a single whole, the contradictory components of which define the development path of an organization.

Based on the stakeholder theory and the resource-based concept of competitiveness, this article analyzes the optimal communication behavior of insurance provider in the Russian market to build an equivalent system for the exchange of resources with their stakeholders depending on the significance of these acquirable resources. The subject of the study is a way towards accessible resources, one that implies the setting of an adequate exchange price for the most significant resources (in the insurance market, these are the insurance premiums).

The study touched upon the cultural impact on the insurance business in Russia and revealed the focus of top management during the periods of growth and decline in the market. Insurance companies can use the present findings as a framework in strategic risk management regardless of theier business scale and territorial affiliation. The article demonstrates that a non-equivalent insurer-stakeholder exchange problem can be solved by establishing a strategic state program for the insurance industry development with foundations laid not only for compulsory insurance but also for the statutory regulation of non-compulsory insurance.

As part the study, impacts on the relationship system present in the insurance business were identified. The results served an input into a resource exchange model, and statistical data on the Russian insurance market situation were compared graphically. The nature of cause-and-effect relationships between macro factors and financially stable companies was defined.

Keywords: stakeholders, financial stability, resource approach, acceptable exchange zone, insurance market.

JEL: G32, G34

Introduction

Compliance of the resource exchange arranged by the insurer with its stakeholders (from the perspective of the stakeholder theory stakeholders are understood as suppliers or resources for the company operations interested in steady payments at competitive prices for such resources, i.e. in a stable and efficient company functioning) with the model in which the exchange results meet to the maximum the requirements of stakeholders is one of the crucial preconditions of the insurer's solvency and financial stability. Failure to meet the requirements of offering a competitive price for the resources which should be considered a reasonable price results in loss of relationships with stakeholders and loss of access to the resources they supply [1].

The stakeholder theory asserts that when the company objectives are achieved various interests of different concerned parties (stakeholders) who will represent a kind of informal coalition should be taken into consideration. There may be various relations among the stakeholders which do not always represent cooperation, coincidence of wants, and they also may be of a competitive character. However, all stakeholders may be considered as an integral controversial whole which parts' interests resultant force will define the company development pathway. The precondition for creation of the optimum behavioural strategy is correspondence of significance of resources of each group to the place in the acceptable solution area at the offered purchase price [2]. When considering stakeholders as suppliers of the resources purchased by the company one should consider the interests not just of shareholders, but also of employees, customers, suppliers among which hired manages hold a special place. They bear social responsibility to other concerned parties (employees, government agents, journalists, citizens) and approve of the strategy of satisfying their expectations [3].

Risk of loss of creditworthiness and, consequently, of paying capacity increases if payment to some stakeholders does not correspond to their role in the optimal model of the company strategic management due to misperception of importance of such role or to execution of the task of retaining certain stakeholders' groups. Interests of resource suppliers for an insurance company and consequences of their nonoptimal serving give rise to 5 disconnected points of corporate interests:

1) The staff wishes to have a maximum remuneration at minimum efforts. Growth of the staff remuneration entails increase of unit costs while minimization of efforts causes narrowing of the insurer's competence. Narrowing of competence inevitably impacts on the quality of insurance services which also degrades. Quality deterioration makes it necessary to reduce prices for insurance services transforming competition into a pure price dumping used to avoid loss of the insured. Price decrease when unit costs grow results in decline in business solvency and over the long term – in red ink position.
2) The insured make the insurance company increase the scope of coverage and decrease prices for insurance services. The scope of coverage is usually expanded due to higher insurance premiums which form the claims reserve. If insurance premiums are not increased when the scope of coverage is expanded, as a consequence, the company will lose its business solvency which will make the company spend its proprietary funds, decrease the return on equity and over the long term it may cause inconformity of the capital with statutory requirements and loss of the right to carry out the insurance business.
3) Insurance agents and brokers insist on increase of their remuneration and react against responsibility for non-conformity of the price of the sold policy to the scope of the risks for which the insurance coverage has been provided. This causes unreasonable expenses related to conducting the case and exceedance of the combined loss ratio of insurance operations over the norm coefficient stipulated in the insurance tariff. The outcome is not just a decline in business solvency, but also loss of the insured discontented with unjustified refusals to pay insurance compensations as well as loss of the market segment by the insurance company [4].
4) The shareholders try to increase the profit making the profitability of insurance transactions grow. The easiest way to increase profitability is to reduce unit costs when the prices grow. In such case decrease of costs of the insurance company is usually accompanied by reduction of expenses on staff, advertisement, technical maintenance and information support. Moreover, in the Russian market environment shareholders of the insurance company dictate the payment policy. They demand reduction of the amounts of insurance compensation in order to redistribute the rest of the earned premium among themselves. This means that quality impairment of insurance services is not accompanied by a corresponding reduction in their price. The opportunity to increase prices when the quality declines exists only in monopolized markets. Thus, under the shareholders' pressure the company leaves competitive markets and strives to isolate itself in monopolized markets.
5) Public authorities, as well as other stakeholders, try to get the maximum returns applying minimal efforts. Democratically elected public authorities in this case will guard interests of the most numerous stakeholders of the insurance company – the insured, striving to increase the insurance density. The corrupt practices existing among public authorities will transform their functions from the "observer" into the "top owner of the company" interested in financial benefits. Serving these interests increases expenditures of the insurance company.

Thus, the corporate strategies should comprise interests of financial and non-financial stakeholders [5] in order to have an opportunity to solve the conflict of interests of concerned parties by piecemeal at any level, thus ensuring the management of the company value [6]. Apart from that, exactly the balance of interests of various concerned parties guarantees a consistent and ethical creation of value [7].

Used in the corporate strategy the stakeholder approach is implemented into each functional division of the company: for example, depending on the chosen strategy of corporate development and satisfying the interests of stakeholders a different structure of corporate management is observed [8]. This provides a special influence on budgeting and financial analysis of the company. Such influence causes establishment of a new company financial architecture and emerging of new (corporate) indicators of the company performance measurement in the market [9].

Often influence of the concerned parties on the company commercial success is significantly greater than that of many operating procedures, such as, for example, distribution of profits [10]. Thereby the stakeholder management which varies in time the prioritization of interests of one or another stakeholder [11] makes the corporate strategy more adaptive to the market environment and provides facilities to make the functioning of the certain company ecosystem stable.

Research Methodology

The research is based on use of the graphical method of analysis of quanta data as well as the inductive approach of finding out the set of elements of concerned parties. For processing of quanta data the programs STATISTICA and Graph were used, the latter creates a graphic representation of comparable data obtained at the preparatory stage of data acquisition.

When defining the factors of influence on company corporate strategies institutional analysis and identification of elements of influence on the relational system of the insurance business were applied. On the basis of the obtained results the process of resource exchange with various stakeholder groups was modeled.

Literature Review and Research Hypotheses

A consistent and long-term application of the strategy of observing the interests of one stakeholder group causes destruction of the resource base of the insurance business. At the same time total capacity of the whole insurance field, as well as the most important types of competence, first of all, companies' innovativeness are reduced [12]. In order to assess the development potential of the Russian insurance market one may define the stakeholder to which the resource exchange of such market is oriented. Inconformity of the model means that distribution of payment for resources in favour of one stakeholder is made at the expense of an unjustified reduction of payment to the others. It is also necessary to consider absence of insurance culture in the market, among the economic entities and citizens where the insured's opportunities to obtain insurance protection are greatly limited, to be the factor which influences the practice of non-equivalent exchange [13].

When studying the risk level of non-equivalent exchange for the developing insurance business one should define whether the real position in the acceptable prices zone of each stakeholder corresponds to its role in the exchange model [14]. In this case the consumer of the insurance services, i.e. the insured, whose money provide rendering of this service in case of an ideal corporate scenario as a result of distribution of the cumulative risk in the insurance fund by payment of insurance premiums should be acknowledged the most important stakeholder.

A qualitative development of the Russian insurance market, first of all, may be related to reforming of the statutory and regulatory base related to OSAGO (compulsory civil liability insurance for vehicle owners). However, the existing problems of reinsurance, imperfection of insurance mediation and absence of automation of insurance activity slow down the procedures of improvement of the insurance services quality [15]. The objective economic need in use of insurance as a tool of protection of public production, individual entrepreneurship and general level of citizens' welfare is associated with disintegration of economic entities where the level of financial risks and property interests is constantly growing. A public inquiry stimulates transfer to the insurance market which functions on the basis of professional application of economic laws and management tooling. The specific nature of insurance services in the Russian Federation depends significantly on dynamics of development of insurance relations inside the market and mentality of prospective insured [16].

In theoretical approaches to the practical regulation of the insurance market the researchers have opposite opinions where, on the one hand, they adduce arguments for active involvement of the state into business operations of private-sector organizations [17], and on the other hand, they substantiate the position that change of the average qualitative level of insurance services is possible only in case of a competitive market [18], and this provides facilities to distinguish the role of specifics of the corporate strategies in assessment of the insurance business efficiency and helps to study the typical behavioral models of management.

Paradigm divergences, which exist when corporate strategies of Russian insurers are formed, result in disequilibrium of the resource exchange in the business "tradition" of the insurance market and absence of stability (first of all, the financial one) in companies' development. Thus, the need in modeling of the resource exchange processes with various stakeholders' groups arises in order to define the optimum ways of achievement of a sustainable financial development of insurers taking into consideration the Russia market situation.

Figure 1. Model of the acceptable exchange zone with the company resource suppliers [19]

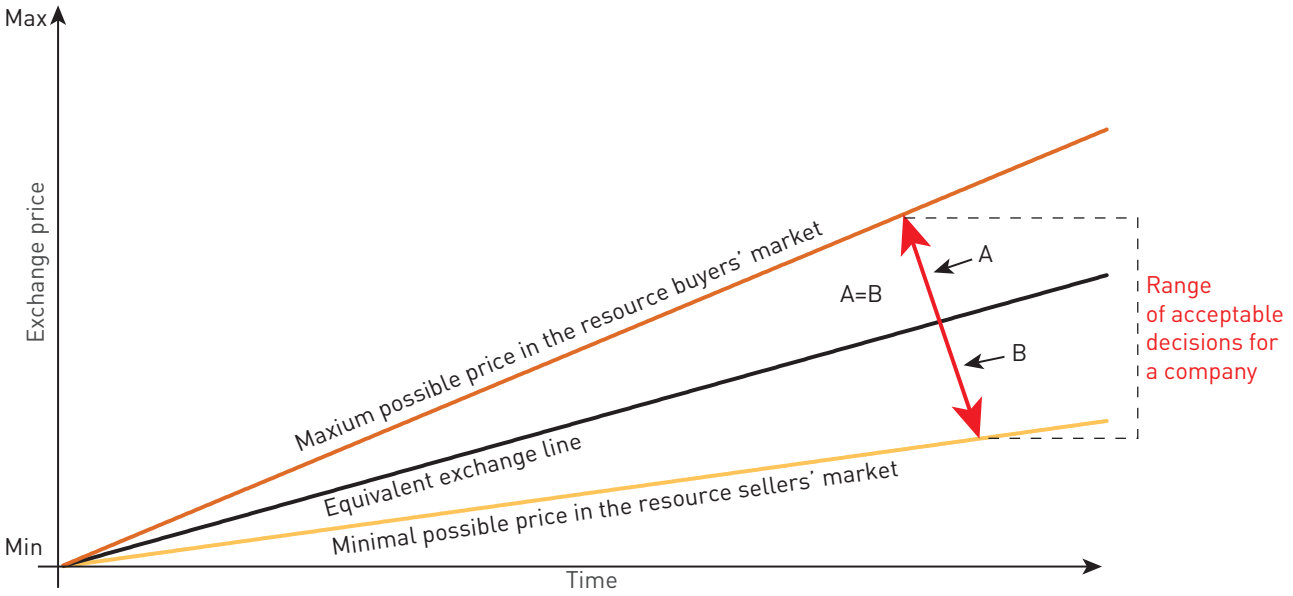
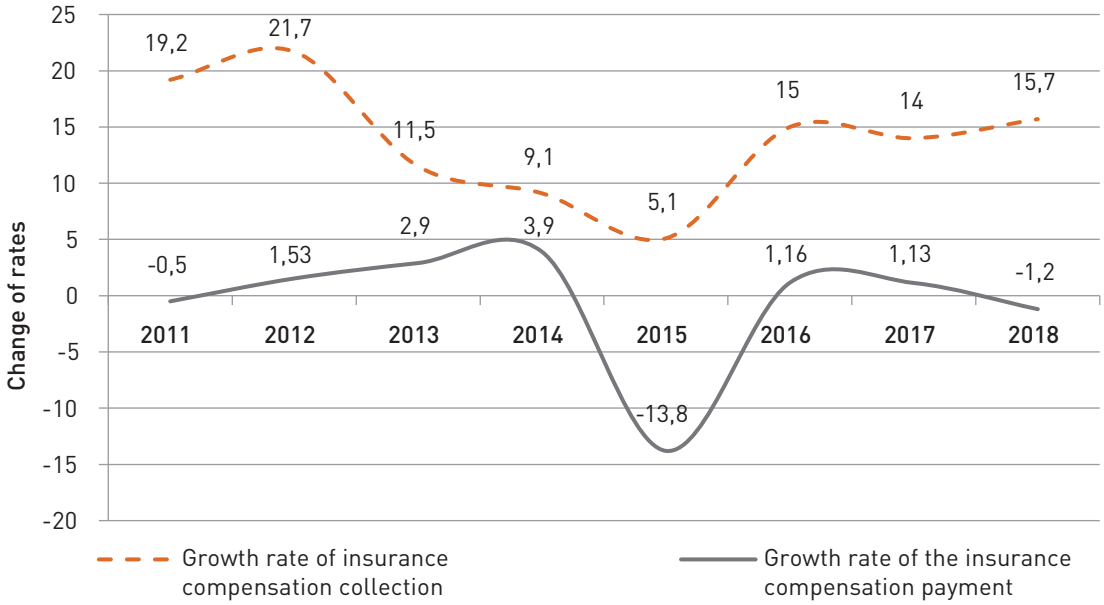


Figure 2. Correlation of growth of the insurance compensations collection rate and the growth rate of the insurance compensation payments coefficient (calculated on the basis of [21-30])



Research Results

Each party assesses the exchange acceptability on the basis of the level of matching of the exchange price with the acceptable solution zone (figure 1). Location of the exchange price with each stakeholder within the acceptable terms means stability of the insurer's access to the resources it needs [19]. Hence, the conclusion on the necessity of control of criticality of deviation of the prices established by the insurer from the equilibrium price in favour of the insurer or the buyer sounds logical.

Going beyond the acceptable terms, as a rule, makes the exchange counterproductive for the "overpaying" or "receiving less than due" party. A conscious acceptance of this situation by the "overpaying" buyer in order to maintain the sustainable financial result may be provided only by means of "underpayment" for another resource. In this case the purchaser of resources manipulates the amount of overpayment or underpayment for the used resources depending on the level of value of access to each resource from the point of view of the predetermined strategy. Providing reliability of communications with the resource suppliers – stakeholders – is the result of formulation of the optimal behaviourial strategy of the insurance company in the market. The correctly defined price paid to each group of stakeholders means that the cost allocation for the resources is optimal and the communications due to which the exchange is organized will be strong enough [20].

Figure 3. Correlation of growth of the insurance premiums collection rates and the growth rate of expenses for conducting a case (calculated on the basis of [21-30])

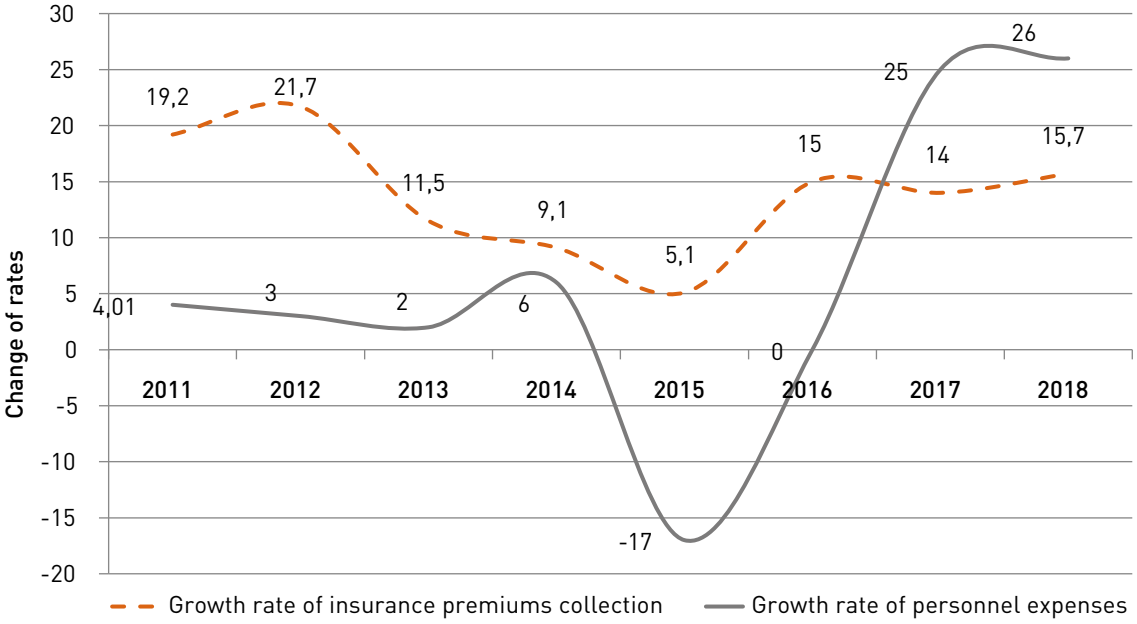
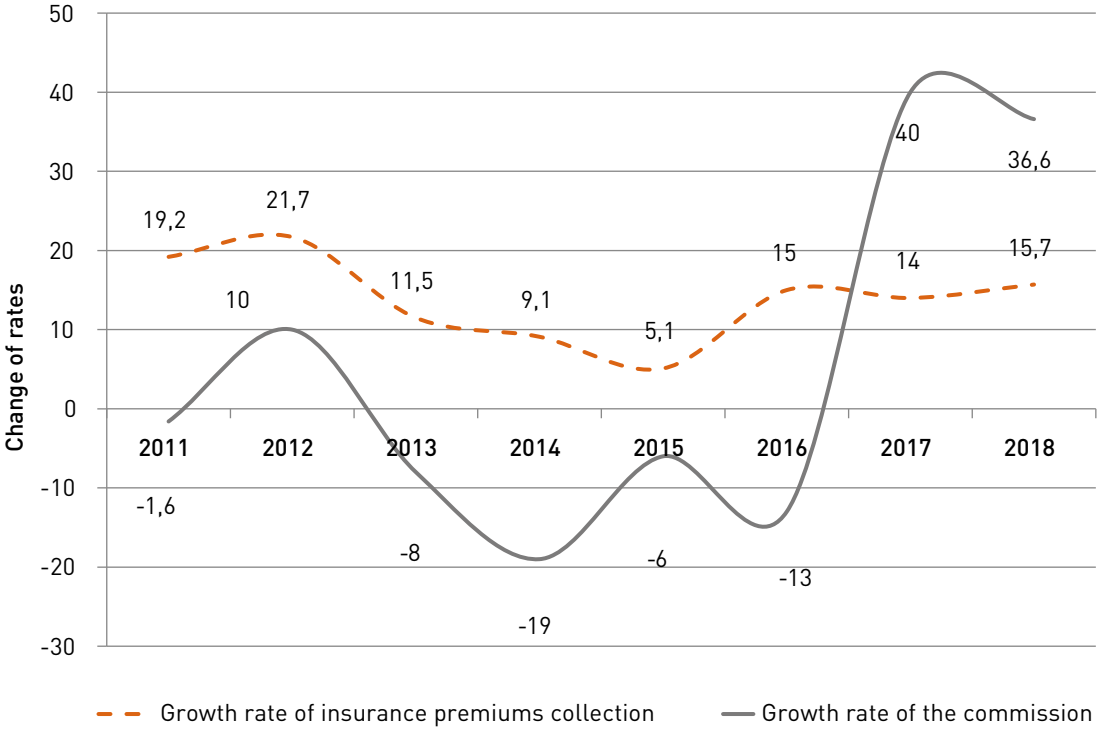


Figure 4. Correlation of growth of the insurance premiums collection rates and the growth rate of the agency commission (calculated on the basis of [21-30])



Let's consider the situation of payment for resources provided by the insuring parties. Payment for their resources is provided by insurance compensations. So, the hypothesis of dependence of the dynamics of their receipt in the current year on the payment dynamics of the previous year is true. This hypothesis is considered to be true on the basis of analysis of the following diagram (figure 2).

Dependence of the chosen indicators is so obvious that a conclusion should be made that the insurance market has an extremely high risk of inequivalent payments to the insuring parties. It is possible to cope with this risk only by a corporate policy of payments of insurance companies which will provide improving competitiveness of insurance services and result in growth of collection of insurance compensations.

In the Russian market realities the coefficient of payments to the insuring parties is the indicator controlled "from above", i.e. it is limited in order to release funds with a view to ensuring interests of other stakeholders. These tactics cause fall of collected amounts and decrease of

the revenues obtained from insuring parties which is the source of payment for all other types of resources necessary for conducting an efficient insurance business. Thus, insuring parties' dissatisfaction with the resource exchange becomes a significant risk of development of the insurance sector.

Another group of concerned parties is the staff. The resource exchange with it also bears the risks of inequivalence. As long as the insurance service over time, to a considerable extent, is provided in the course of communication between the insuring party and insurance specialists, involvement of employees in this procedure is the most important element of providing competitiveness of insurance and permanence of receipt of insurance compensations. Materialization of risk of the exchange inequivalence with this stakeholders' category will result in a loss of the company's human and entrepreneur's capital, decrease of its knowledge capital and deterioration of the market competitivity.

We have analyzed the Russian insurance market situation concerning acceptability of the resource exchange with the staff of the insurance company where we've considered the indicator of expenses for conducting a case as an assessment of payment. A high correlation of indicators of premiums growth rates and the growth rates of expenses for conducting a case (figure 3) is upset only in the period of 2015 – 2016 due to implementation at the initiative of the Central Bank of Russia of expensive equipment for IT-solutions which provide for insurance reports. It did not cause growth of insurance premiums which is illustrative of inefficiency of these measures for insurance companies.

Change of the rates of collections' growth is significantly less than change of expenses for conducting a case. This means that such expenses are inefficient and insurance company's employees, especially the technical staff, get into the category of "incident fellow travelers" and at present their functions are actively transferred to IT-applications. In our opinion, correlation of the analyzed indicators is explained by existence of a highly qualified personnel of insurance professions. Representatives of the above professions ensure de facto the human and entrepreneur's capital of the insurance company. In this regard, it is reasonable to remunerate insurance specialists within the equilibrium price in the area of acceptable exchange [14].

One more supplier of resources for an insurance company is the group of insurance intermediaries who create communications with insuring parties who are traditionally meant to develop loyalty towards the insurer [31]. Remuneration to this category of stakeholders should be analyzed in accordance with dynamics of expenses for the agency commission.

Figure 5. Correlation of growth of the insurance premiums collection rates and the growth rate of insurance density (calculated on the basis of [21-30])

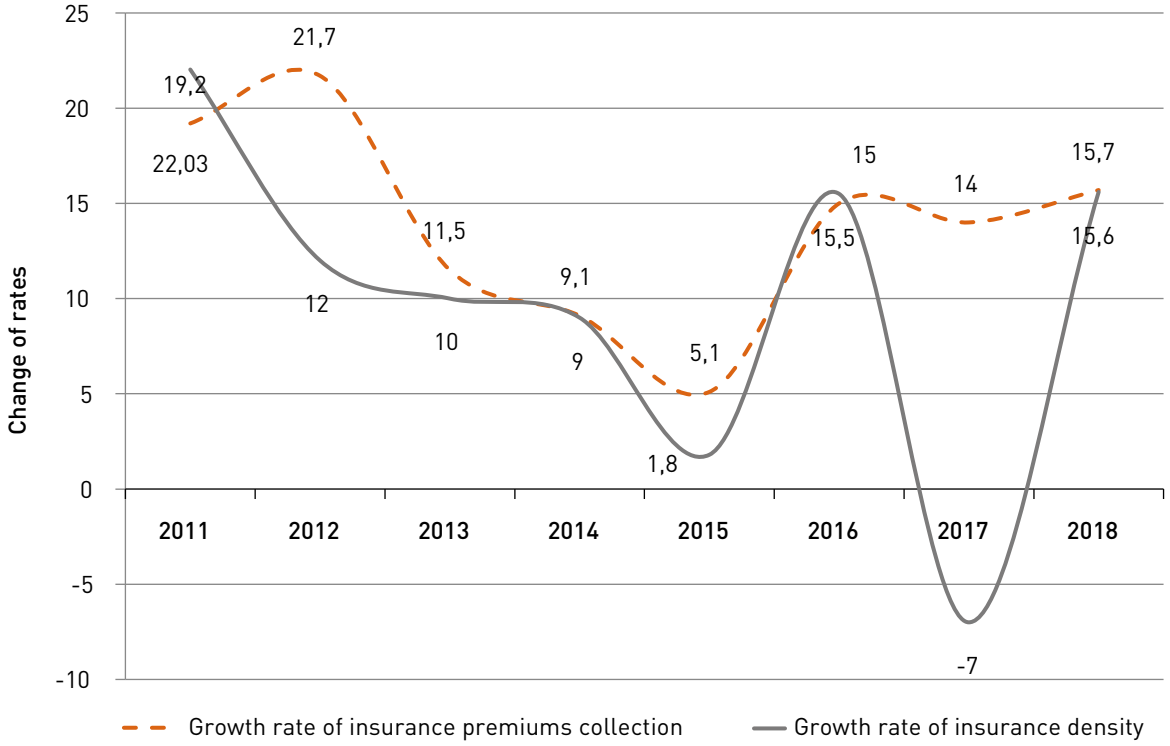


Figure 6. Correlation of growth of the insurance premiums collection rates and the growth rate of joint-stock profit (calculated on the basis of [21-30])

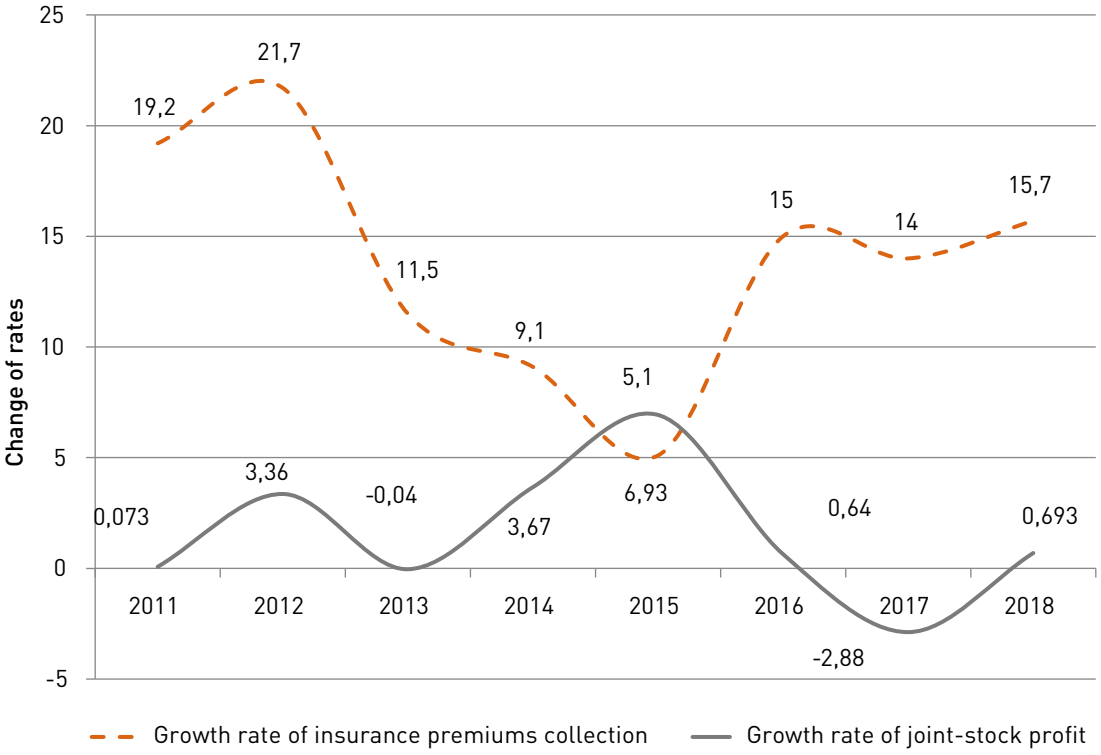
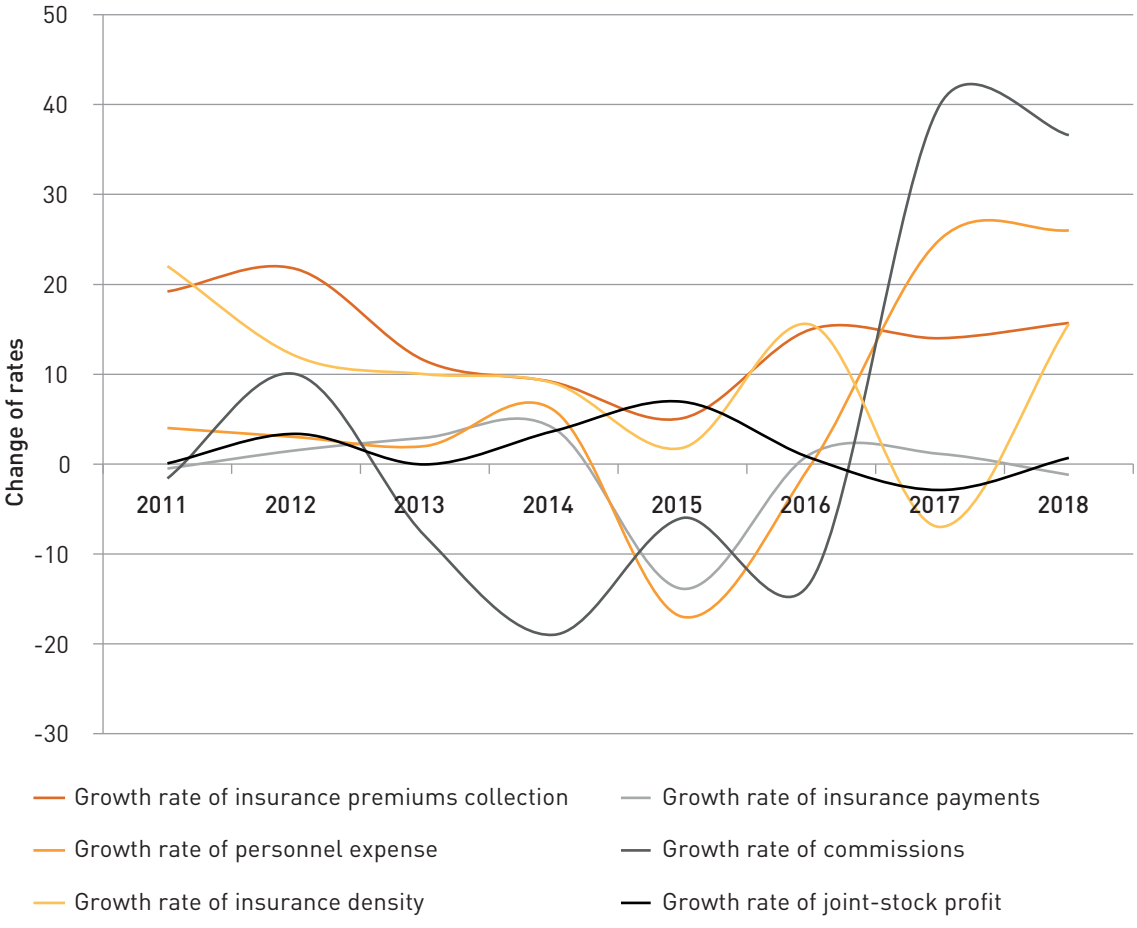


Figure 7. Correlation of growth of the rate of payment for the resources of all groups of stakeholders of an insurance company (calculated on the basis of [21-30])



On the basis of figure 4 we may define that there is an inverse dependence between the insurance premiums collection and paid agency commission. A sharp growth of the rates of its change is related to an unparalleled increase of commissions paid to banks in the course of "bancassurance" [32]. In 2016-2017 it amounted to 49% of the collected premium. The reason for the inverse dependence of the collections increase and the percent of the agency commission is the agents' claim to an increased payment rate in the cases when the customers' interest in purchase of insurance protection decreases. This market phenomenon indicates inefficiency of the agent intermediation because the communication with insuring parties is considered to be more important than the resource of the insuring parties themselves. Strengthening of the tendency of decrease of the rates of payment for the insurance services' consumers' resource may cause falldown of the indicator instead of increase of the number of contracts in the stable portfolio.

The state holds a special place among the insurer's stakeholders. The state's interest in development of the insurance sector manifests itself in growth of the indicators of penetration and insurance density. We have analyzed how Russian companies provide for the growth of the insurance density indicator which illustrates the level of insurance of property interests of citizens and companies (figure 5).

The growth rates of the insurance density slumped up to 2018. There is an intrinsic reason for that: population increase in 2015-2016 related not just to integration of Crimea into the Russian Federation in 2014 but also to rise in births in Russia. Nevertheless, a steep downfall of the growth rate of insurance of economic entities indicates a low popularity of insurance as a tool for providing stability of their financial standing with families from Crimea and families who had newborns within the above period. This state of affairs may be explained by the fact that the state pays no attention to the insurance sector as a tool for maintaining stability and safety of households and small enterprises. As a result, the sector (as a complex of economic entities and communications among them) is unable to solve large-scale tasks. A mutual dissatisfaction means that for the insurers the state is in the category of "incidental stakeholders" which are mutually indifferent to exchange of the existing resources. The lack of the state support resource, insurers increases the possibility of degradation of the sector and losing by it of the status of an item significant for development of the national economy [33].

Shareholders remain the most important stakeholders of any commercial undertaking. If we remove from analysis payment of revenues to the shareholders, which have been earned by investment activities of insurance companies, the source of payment of the share capital (taking into consideration the risk imposed on it) is also insurance premiums which ensure generation of the joint-stock profit. A joint analysis of change of the indicators of the growth rate of joint-stock profits and insurance premiums leads us to the conclusion that since 2013 their dynamics is in the reverse phase (figure 6).

Collection of insurance premiums and their growth rates are the main indicator of increase of the company value as its marketing capitalization. This indicates efficiency of management and becomes its key indicator of efficiency. In this regard in the period of the market revival top managers of corporations increase maximally the expenses which promote growth of revenues. It should be noted that bonuses for the managers in these periods are also calculated on the basis of the collections amount, thus, increasing the company aggregate expenditures. So, in spite of a quantity increase of revenues the growth rate of the generated profit under the conditions of a rising market is dropping.

In the periods of a market downfall the management is focused on a prudent policy of cutting expenditure, and this results in a growth of the rate of the profit increase. We think it is reasonable to state the following hypothesis: by manipulating the shareholders' interests top managers of insurance companies, first of all, ensure payment for their own management resource.

Figure 7 represents changes of the growth rate of the key indicators which show payment for resources of each group of stakeholders of insurance companies.

Analysis of diagram (figure 7) reveals the direct dependence of the growth rate of insurance premiums collection on the growth rate of the level of payment for the resources of all insurance activity participants, except for the shareholders and insurance agents. This confirms once again their special place as stakeholders' groups in the relational system of the insurance company.

Conclusion

The companies should consider the category of insuring parties as key stakeholders and accordingly organize payment for the resources provided by them at the upper limit of the acceptable exchange zone. A low activity of insuring parties dissatisfied with the non-equivalent exchange aggravates the situation where the insurer has an opportunity to pay for the necessary intellectual, organizational, communication resources by decreasing the pay-out coefficient below the fair one in the prejudice of the consumers, or by decreasing the amount of the revenue due to the shareholders in the prejudice of the latters. In this case a frequent corporate practice is the focus of the insurer's top managers, who dispose of the financial flows, on their needs as the ones of the highest priority. Little interest of public authorities, the state's voluntary non-participation in the insurance market as a key stakeholder prevents from providing of meeting the requirements of the equivalent exchange for resources of various types and, as a consequence, from fulfilling the potential of extensive development of the insurance niche. Such distortions in the equivalent exchange model bear the risks of degradation of individual corporations as well as of the insurance sector in general.

A strategic state program of the insurance sector development may become the factor which can normalize the situation of non-equivalent exchange of the insurer with the stakeholders. The program should lay the foundation not just for implementation of obligatory insurance types, but also for the statutory regulation of their imputed types, all the more so because the imputed insurance is increasingly widely replaced by a membership in self-regulating organizations. As long as the main problem of insurance resides in its "non-transparency" for the consumer, apart from the program of development of the population financial literacy it is necessary to stimulate creation of such products the solutions of payment for which are indisputable and amounts of payment are fair in relation to the paid contributions. The interest in creation of new insurance products with participation of the state should not concern only insurance interests of the global value. In practice it is widespread in the agricultural insurance system. The need in mass insurance products of interests' insurance characteristic of individual homogeneous population groups using electronic means of communication with a simple way of concluding a contract and claims settlement is observed among the players. Taking into consideration the cheapness of insurance offers they are unlikely to be interesting for large insurance companies or their local dependent branches. This in its turn will be a motivation for small companies to increase their market share.

In case of existence of a "proportional" regulation, i.e. the requirements of capitalization of insurance companies in accordance with the specific character of the territory where the companies conduct their principal activities the corporations are able to create and service the products targeted at the local market because they know better the specifics of the market situation in their region. Interest of the local authorities in solving the regional problems and their broad understanding of territorial problems as well as the possibility of creating the systems using electronic and phone communication when concluding an insurance contract and claims settlement ensured within a private-public partnership may be the foundation for the practice of making by the companies of a stable corporate insurance portfolio and to show the state importance of insurance when ensuring the stability of public production, decrease of social risks and creation of additional budget revenues.

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The impact of diversification of production activities by major public oil companies on the value of their shares

Evgeny Busygin
PhD student
ORCID
E-mail: egbusygin@edu.hse.ru

National Research University Higher School of Economics, Moscow, Russia

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The impact of diversification of production activities by major public oil companies on the value of their shares

Abstract

The studies devoted to the analysis of the diversification of production activities of the largest public oil companies and its impact on their cost do not consider production or financial factors, which are important indicators for assessing the development prospects of companies.

In this article, an econometric analysis will be carried out to identify the external and internal factors affecting the capitalization of the largest vertically integrated oil companies, and for the first time, profitability ratios for each of them will be used to test the hypothesis about the positive impact of diversification of activities on the upstream and downstream segments.

As a result of the study, it was found that an increase in profitability in the upstream segment leads to an increase in the value of oil companies shares, while profitability in the downstream segment turned out to be an insignificant factor that negatively affects the dependent variable.

The obtained results indicate that investors are more oriented to the financial indicator related to the production sector, ignoring the refining segment, which may lead to underestimation of oil companies and subsequent adjustments of stock prices.

The final conclusions can be used by investment companies and other stock market participants as part of investment decision making process regarding the acquisition/sale of shares of large vertically integrated oil companies.

As part of the development of a study on the valuation of oil companies, it could be analyzed the influence of the factors considered in the work on firms that conduct production activities separately in upstream and downstream segments.

Keywords: market capitalization, oil industry, system of factors, Tobin's Q, upstream and downstream, M&A

JEL classification: C10, G32, L16, P18

Introduction

Assessment of prospects of the future rise in value of investment projects is the basis for beneficiaries when making an investment decision. In order to define the current value of an asset and its capability to generate dividends within the chosen time horizon it is necessary to carry out a complex analysis of the factors which influence directly its value. The purpose of the present paper is revealing the group of such factors using an oil company as an example.

A distinguishing feature of defining the investment potential of resource-extracting companies is the necessity of analysis of their dependency on the raw materials prices and considering of their mechanisms of protection from reduction of the amount of financial receipts with the existing risks of high volatility in the raw materials markets. The macroeconomic analysis of the petroleum industry and its prospectives will give us an opportunity to answer the important question of expediency of purchase of oil companies' shares in crucial respect.

Due to a rapid growth of the global economy from 1965 to 2017 the demand for oil increased almost thrice from 1,524 до 4,470 million tons. The biggest contribution in the growth of the composite demand was made by Asia region where the considered indicator increased within the above period more than 9 times (from 163 to 1,598 million tons), while in North America the oil demand increased less than twice (from 620 to 1,056 million tons). This is due to a rapid development of the economies of Asia region. A notable increase of the share of oil consumption in this region also confirms this fact. From 10 % of the total world amount in 1965 it rose to 34.7 % by 2015 and in 2017 it amounted to 35.7 %.

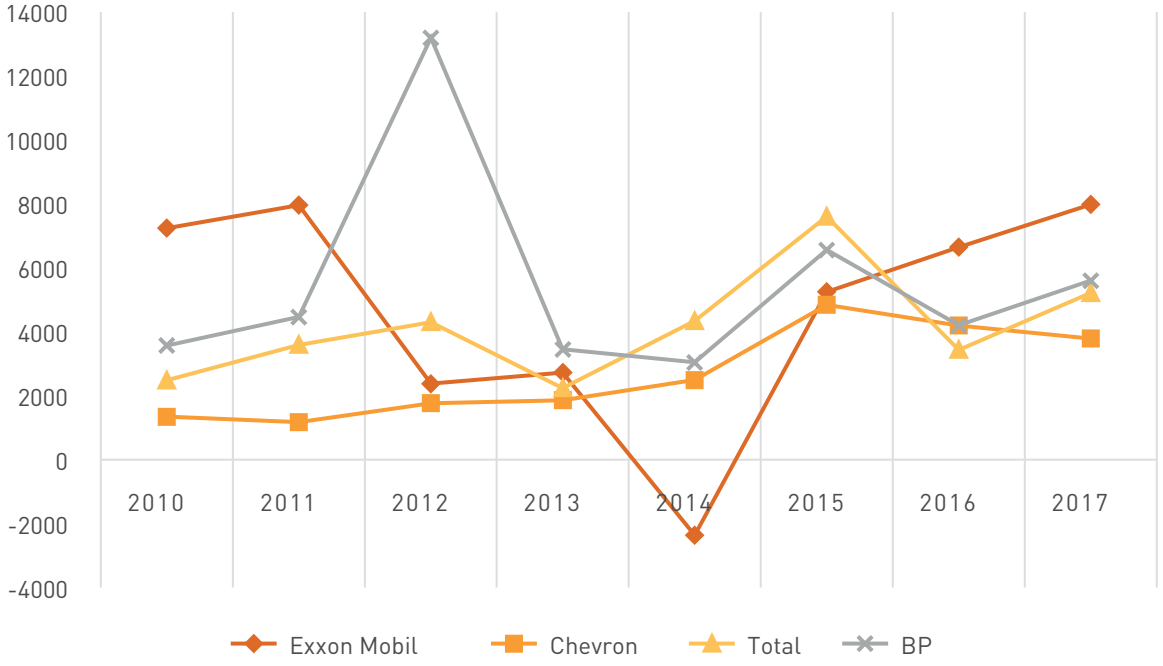
As the results of predicted values of the global oil demand presented in the reports of the global analytical organizations (BP, IEA, OPEC, Institute for Energy Studies of the Russian Academy of Sciences) show the average value of demand by 2040 will be 4,916 million tons, and it exceeds the corresponding value of 2016 by 13%.

It is important to note that in spite of differences in predicted values of demand for energy resources represented in analytical reports of various agencies and organizations an overall trend of oil demand in the coming decades can be seen. It means that development of the oil industry will go on and it will continue to generate profits for its shareholders.

When taking the optimal investment decision stock market traders use the methods of defining the fair value of public companies. Carrying out such analysis it is necessary to take into consideration as much factors influencing the share prices as possible. At present the issues related to assessment of capitalization of oil companies are of greatest relevance due to a high price volatility in the oil market which emerged in 2014.

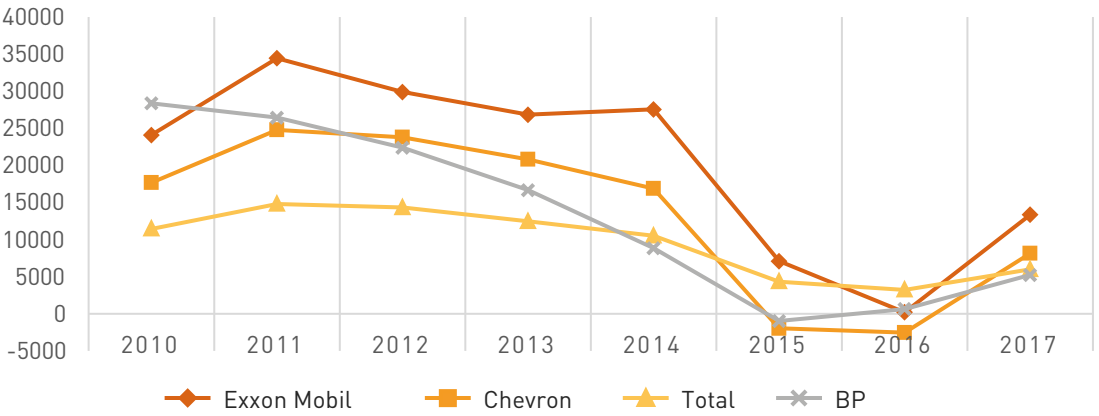
One of the mechanisms which protect capitalization of oil companies from decline is diversification of production activities into upstream and downstream segments. Figures 1 and 2 illustrate a collapse of operating income in the upstream segment for the largest oil companies Exxon Mobil, Chevron, BP and Total in 2014-2015 when oil prices fell significantly, while the same indicator in the downstream segment showed growth within the same period. The presented diagrams show that operating income in the downstream segment is unresponsive to the changes of the oil market which, in its turn, explains why prices of the companies' shares were not reduced pro rata with the fall in oil price.

Figure 1. Operating income of oil companies in the upstream segment from 2010 to 2017 (million US dollars)



Source: made by the author on the basis of companies' annual reports.

Figure 2. Operating income of oil companies in the downstream segment from 2010 to 2017 (million US dollars)



Source: made by the author on the basis of companies' annual reports.

The mechanism of activities diversification of the largest vertically integrated oil companies from the point of view of analysis of financial flows' cost-effectiveness in the upstream and downstream segments has not been studied before. Apart from diversification it is necessary to define and analyze other factors on which capitalization of oil companies depends.

Review of Literature

The majority of researches dedicated to assessment of influence of various factors on capitalization of oil companies are focused on detecting of influence of financial indicators which are external for the companies, for example, change of oil price [6; 7; 10; 12; 15], movement of stock indexes [14], inflation fluctuation and industrial production index [17].

Another group of papers considers not just external factors which are independent of the company operations, but also internal ones – financial and production indicators of companies [8; 11; 13].

The influence of the activity diversification is analyzed from various perspectives, for example, from the point of view of corporate management mechanisms [2] of oil companies in the upstream and downstream segments is considered in a small number of papers dedicated to analysis of influence of factors on companies' capitalization [3; 8; 12; 17].

Analytical paper [3] showed a useful effect of diversification of economic operations for oil companies which manifested itself in smoothing the risk of influence of the falling oil price on financial indicators of large companies in 1997 which was caused by a large cash flow from sold oil products. Influence of diversification was not studied in the paper from the econometric point of view.

Conclusions on existence of the asymmetric effect of influence of the oil price change and cost of companies' shares are stated in the following econometric papers. Research [15] makes the conclusion that growth of oil prices influences the prices of oil companies' shares more than fall of these prices.

However, it should be noted that the final conclusion in the paper was made on the basis of analysis of the selection which comprised large vertically integrated companies (BP, Roya Dutch Shell), as well as the companies which conducted business only in the upstream segment (Pharos Energy, Tullow Oil, Afren etc.). In this regard it is reasonable to carry out a more thorough econometric analysis using a homogeneous sampling which consists only of vertically integrated companies. Besides, among the independent variables applied by the authors of the research there are only financial indicators such as market risk calculated using the London Securities Exchange index, expected daily profitability of shares, oil price. Operational and financial indicators of the companies themselves are not included in the research.

In the other paper dedicated to revealing the asymmetric effect of influence of oil price change on share prices of oil companies the authors conducted the econometric analysis separately for the companies of the upstream segment and those from the downstream segment [17]. The research also states only external factors such as oil prices (Brent, WTI and Dubai) and macroeconomic indicators (inflation, industrial production index). The main conclusion of the paper made by the authors is that share prices of oil companies react asymmetrically to change of oil prices irrespective of the macroeconomic environment in the market, for which reason the authors think that investors should assess oil companies in more than one way in case of diversification of risks of the portfolio they build up.

In paper [12] the authors study external and internal factors and make the conclusion that different structure of amounts which account for the upstream and downstream segments of large vertically integrated companies results in a differently directed movement of shares' price of these companies in case of oil prices growth. However, just as in previous researches the authors focus on the cost of shares and their dependency on oil prices (the difference between the future and spot prices for oil) not including operational and financial factors of companies. However, unlike in previous papers the authors study six

largest vertically integrated companies (including Chevron, Exxon Mobil, Eni) but the econometric analysis is conducted for each company individually.

The authors of research [13] found out that irrespective of the sector of a resource-extracting company the revenue, mineral resource price and EBITDA are the underlying determinants which influence the value of securities. Just as in previous studies macroeconomic factors are not presented in this paper, in article [12] an individual approach to companies is applied – four companies from various sectors, including the power industry, thus it does not give a full picture of the sector because the obtained results may be accounted for the considered companies' leadership or range of activity (capitalization of each company exceeds 25 billion US dollars). Revealing of the diversification effect is not considered.

To sum up the results it should be noted that in the majority of the considered researches dedicated to analysis of the factors which influence capitalization of oil companies' operational and financial indicators which are important indices of assessment of a company development potential have not been considered. In this paper we will carry out the econometric analysis to find out external and internal factors which influence capitalization of the largest vertically integrated oil companies and we will use profitability ratios for the upstream and downstream segment for the first time in order to verify the hypothesis of a positive influence of activity diversification on the above segments.

Research Methodology

For the purpose of our research the following model was used as a basis [13]:

$$m_{it} = A_i + aP_t + \sum_{i=1}^{n} \beta_i KPI_{it} + \gamma R_{it} + u_t, \quad (1)$$

where m_{it} – ratio of EV (enterprise value) to DACF (debt-adjusted cash flow), A_i – a set of dummy variables specific for the company (fixed effects), P_t – price for Brent oil, KPI_{it} – vector of key performance indicators (production volume, costs, expenses for exploration and exploitation of deposits, Reserves Replacement Ratio and others), R_{it} – RoACE.

This model was chosen because it meets the criteria necessary to conduct our research. It comprises the most essential indicators of oil companies' activity, companies' value, besides, the model is intended for using panel data. For the purpose of our research we specified the model as follows.

$$\begin{aligned} Share\_price_{it} &= \beta_0 + \beta_1 * ROE_{it} + \\ &+ \beta_2 * Down\_income_{it} + \beta_3 * DPO_{it} + \\ &+ \beta_4 * Tobin_{it} + + \beta_5 * S\_ratio_{it} + \\ &+ \beta_6 * Prof\_down_{it} + \beta_7 * Prof\_up_{it} + \\ &+ \beta_8 * Cap\_d_{it} + \beta_9 * Purch\_oil_{it} + \\ &+ \beta_{10} * M\_A_{it} + u_i + e_{it} \end{aligned}, \quad (2)$$

where Share_price – price for companies' shares; ROE – return on equity; Down_income – ratio of income in the downstream segment to the consolidated profit in the upstream and downstream segments; DPO – dividend payment ratio; TobinQ – ratio of the company market value to its book value [4]; S_ratio – debt ratio; Prof_down – profitability of sales in the downstream sector; Prof_up – profitability of sales in the upstream sector; Cap_d – capital expenditures for downstream operations as related to aggregated capital expenditures; Purch_oil – the share of purchased oil in the prime cost; M_A – dummy variable, where 1 means a M&A deal, 0 – its absence.

The research will be carried out on the basis of the data obtained by the authors for 5 largest oil companies (Chevron, BP, Royal Dutch Shell, Total, Exxon Mobil) over the period of the 1st quarter of 2006 to the 3rd quarter of 2016. The information on M&A deals was collected using the database of Thomson Reuters Eikon; the financial indicators have been calculated by the authors on the basis of the information from Thomson Reuters Eikon database as well as from quarterly reports of companies (available at the electronic resources of such companies as well as in the database of SEC EDGAR System).

In the furtherance of our objective we will verify the following hypotheses:

- Increase in profits in the downstream segment has positive effect on securities value;
- Growth of profitability of sales in the upstream and downstream segments has positive effect on companies' share value;
- Increase of debt load depreciates share value;
- Increase of capital expenditures for the downstream segment has positive effect on company capitalization;
- M&A deals influence share value.

Data Analysis

Before drawing up the regression we preprocessed the obtained data, the results are presented in Table 1. On the basis of the analysis, one can conclude as follows:

1) the company Exxon Mobil has the maximum value of Tobins'Q of 2.14 and it is the only company which has the mean value and median value of Tobins'Q above 1. Further, it means that this company for a long time has been assessed by the investors as more attractive for investment and this resulted in its overestimation;
2) the average of S_ratio in the selection amounts to 0.59, i.e. on average a little bit over 50% of companies' assets are comprised of debt capital. Such significant size of the share of raised funds is accounted for investment projects which are characteristic of oil industry and are distinct in capital capacity and longtermness;
3) Exxon Mobil shows the highest mean and median value of return on share capital which indicates efficiency of its business activities;

Table 1. Descriptive Statistics Dependent and Independent variables for Each Company

	SHARE PRICE	TOBINQ	S_RATIO	ROE	PURCH OIL	PROF UP	PROF DOWN	M_A	DPO	DOWN INCOME	CAP_D
BP											
Mean	48.48	0.60	0.61	0.03	0.86	0.30	0.02	0.86	0.22	0.24	0.18
Median	44.29	0.48	0.61	0.04	0.88	0.34	0.02	1.00	0.32	0.18	0.18
Maximum	73.95	1.14	0.66	0.13	0.95	0.77	0.05	1.00	1.67	2.79	0.35
Minimum	28.88	0.34	0.57	-0.20	0.58	-0.22	-0.03	0.00	-3.33	-0.58	0.08
Std, Dev,	12.75	0.24	0.02	0.05	0.06	0.21	0.02	0.35	0.79	0.50	0.07
Skewness	0.58	0.99	0.21	-1.93	-2.48	-0.73	-0.25	-2.08	-2.17	3.21	0.52
Kurtosis	2.21	2.58	2.26	9.71	11.02	3.68	3.90	5.33	11.01	17.11	2.52
CHEVRON											
Mean	93.63	0.95	0.44	0.04	0.70	0.48	0.02	0.65	0.26	0.15	0.12
Median	93.58	0.94	0.43	0.04	0.70	0.51	0.02	1.00	0.28	0.13	0.10
Maximum	130.55	1.42	0.50	0.09	0.89	1.06	0.09	1.00	3.57	4.01	0.28
Minimum	57.97	0.55	0.41	-0.01	0.44	-0.66	-0.01	0.00	-3.45	-2.89	0.04
Std, Dev,	19.57	0.18	0.03	0.02	0.11	0.39	0.02	0.48	0.97	0.83	0.06
Skewness	-0.03	0.34	0.71	-0.44	-0.48	-1.29	1.04	-0.63	-1.12	1.14	0.82
Kurtosis	1.90	3.20	2.04	2.65	2.78	4.41	4.50	1.40	10.98	16.32	2.57

	SHARE PRICE	TOBINQ	S_RATIO	ROE	PURCH OIL	PROF UP	PROF DOWN	M_A	DPO	DOWN INCOME	CAP_D
EXXON MOBIL											
Mean	81.08	1.36	0.51	0.06	0.75	0.68	0.02	0.81	0.41	0.25	0.17
Median	83.88	1.21	0.50	0.06	0.76	0.73	0.02	1.00	0.27	0.18	0.12
Maximum	101.20	2.14	0.55	0.12	0.80	1.10	0.07	1.00	1.83	1.09	0.83
Minimum	57.07	0.91	0.48	0.01	0.63	-0.02	0.00	0.00	0.14	-0.03	0.05
Std, Dev,	11.30	0.34	0.02	0.03	0.04	0.26	0.01	0.39	0.38	0.22	0.21
Skewness	-0.31	0.87	0.17	0.05	-1.15	-1.14	1.35	-1.61	2.53	1.88	2.62
Kurtosis	2.26	2.60	2.40	2.49	3.54	4.01	6.52	3.60	8.94	6.97	8.24
ROYAL DUTCH SHELL											
Mean	24.54	0.68	0.53	0.03	0.91	0.35	0.01	0.93	0.91	0.16	0.19
Median	25.19	0.62	0.53	0.03	0.91	0.43	0.01	1.00	0.41	0.23	0.17
Maximum	30.33	1.10	0.59	0.08	0.97	0.71	0.05	1.00	6.71	4.86	0.40
Minimum	16.93	0.42	0.49	-0.05	0.83	-1.07	-0.01	0.00	-0.87	-6.68	0.09
Std, Dev,	3.36	0.18	0.03	0.03	0.03	0.31	0.01	0.26	1.38	1.37	0.07
Skewness	-0.32	1.03	0.23	-0.50	-0.70	-2.55	1.15	-3.38	2.69	-2.13	0.87
Kurtosis	2.45	3.02	2.61	3.46	3.06	11.43	4.05	12.41	10.54	18.79	3.63

	SHARE PRICE	TOBINQ	S_RATIO	ROE	PURCH OIL	PROF UP	PROF DOWN	M_A	DPO	DOWN INCOME	CAP_D
TOTAL											
Mean	44.19	0.69	0.59	0.04	0.74	0.17	0.02	0.84	0.41	0.79	0.13
Median	42.58	0.60	0.59	0.04	0.74	0.21	0.02	1.00	0.52	0.17	0.12
Maximum	60.26	1.19	0.64	0.10	0.95	0.35	0.08	1.00	1.93	25.59	0.34
Minimum	33.24	0.45	0.57	-0.06	0.60	-0.41	-0.08	0.00	-3.19	-0.61	0.04
Std, Dev,	6.77	0.23	0.02	0.03	0.06	0.13	0.03	0.37	0.78	3.88	0.06
Skewness	0.69	0.94	1.05	-0.93	1.14	-3.17	-1.09	-1.83	-2.18	6.28	1.05
Kurtosis	2.40	2.44	3.41	5.38	7.55	13.80	5.44	4.34	12.13	40.66	4.05

4) Royal Dutch Shell shows the highest mean value of DPO – 0.91, but it should be taken into consideration that the mean value is 0.41 (50% of quarterly dividend payout against profit was less than 0.41);
5) for the majority of considered variables |As| > 0.5 which is indicative of a significant asymmetry. Over 50% of observations for each variable have values below average. This fact is accounted for abnormally high observation results which, in our case, cannot be excluded because it will impair the research quality;
6) for all variables Ek > 1 which is indicative of significant kurtoses. In other words, the distribution curves of observations are characterized by peakedness while the observations themselves cluster around the mean value.

On the basis of the submitted data one may make a conclusion of existence of moderate significant positive relations between the following factors: Prof_down and Down_income, TobinQ and ROE, Prof_up and TobinQ, Prof_up and ROE. There are no strong relations between the dependent variable and independent ones, as well as there are no such relations between independent variables themselves (modules of obtained correlations do not exceed 0.8) which is indicative of absence of multicollinearity. Nevertheless, let's calculate variance inflation factors (Table 2). As long as VIF of each explanatory variable is less than 10 it indicates absence of multicollinearity between the variables [24, p. 39].

Table 2. Calculation of variance inflation factors

Variable	VIF	1/VIF
TobinQ	2.5	0.400065
Prof_up	2.45	0.408689
ROE	1.99	0.503379
Purch_oil	1.77	0.564856
S_ratio	1.6	0.623972
Prof_down	1.38	0.724882
Cap_d	1.16	0.864453
DPO	1.13	0.882653
M_A	1.1	0.912802
Down_income	1.09	0.918572
Mean VIF	1.62	

Source: comprised by the author.

We conducted a Breusch-Pagan test for heteroscedasticity where Prob = 0.1946 which exceeds 0.05. So, the null hypothesis is not rejected, hence we can make the conclusion of absence of heteroscedasticity.

The final results of the developed models are presented in Table 3. Developed model 1 of pooled regression is significant at any reasonable level of significance because Prob is less than 0,01. R-squared amounts to 0.69. As judged by the model such independent variables as Prof_down, DPO, Down_income, ROE turned out to be insignificant at the level of significance of 10%.

In order to take into consideration the time component model 2 with fixed effects was developed which is significant at any reasonable level of significance (Prob < 0,01); R-squared (within) amounts to 0.2895. On the basis of the obtained results one may make the conclusion that inter-individual differences between companies manifest themselves stronger than dynamic ones. As long as all predicated variables vary with time all ratios have been evaluated.

The major part of the considered variation of data can be attributed to individual effects: rho = 0.70. The results of F-test indicate that it is necessary to use the deterministic effects model. On the basis of the model the independent variables such as ROE, Prof_up, Prof_down, M_A, DPO, Down_income were insignificant.

Conclusion

The results of verification of hypotheses in accordance with the regression analysis using the fixed effects model are presented in Table 4.

Analyzing the influence of the production activities diversification by the largest vertically integrated companies applying the approach which divides factors into profitability in the upstream and downstream segments it should be noted that growth of profitability in the upstream segment results in increase of shares' price while profitability in the downstream segment turned out to be an insignificant factor which adversely affected the dependent variable.

The obtained results indicate that investors pay more attention to the financial indicator related to the upstream segment leaving aside the downstream segment and this may cause underestimation of oil companies and subsequent correction of shares' prices. This conclusion is confirmed by behavour of oil companies' securities (Figure 3).

Companies' capitalization follows change of oil price but it does not decline so much as the price for the above energy source. Since 2013 and by 2015 the oil price had slumped by 60%, while within the same period the price for shares of the companies Chevron, ExxonMobil and Royal Dutch Shell, taken as an example, reduced by 28%, 23% and 36% respectively. It should also be noted that as a part of price recovery which started in 2015 the price of oil companies' shares bounced back almost to the figure of 2013.

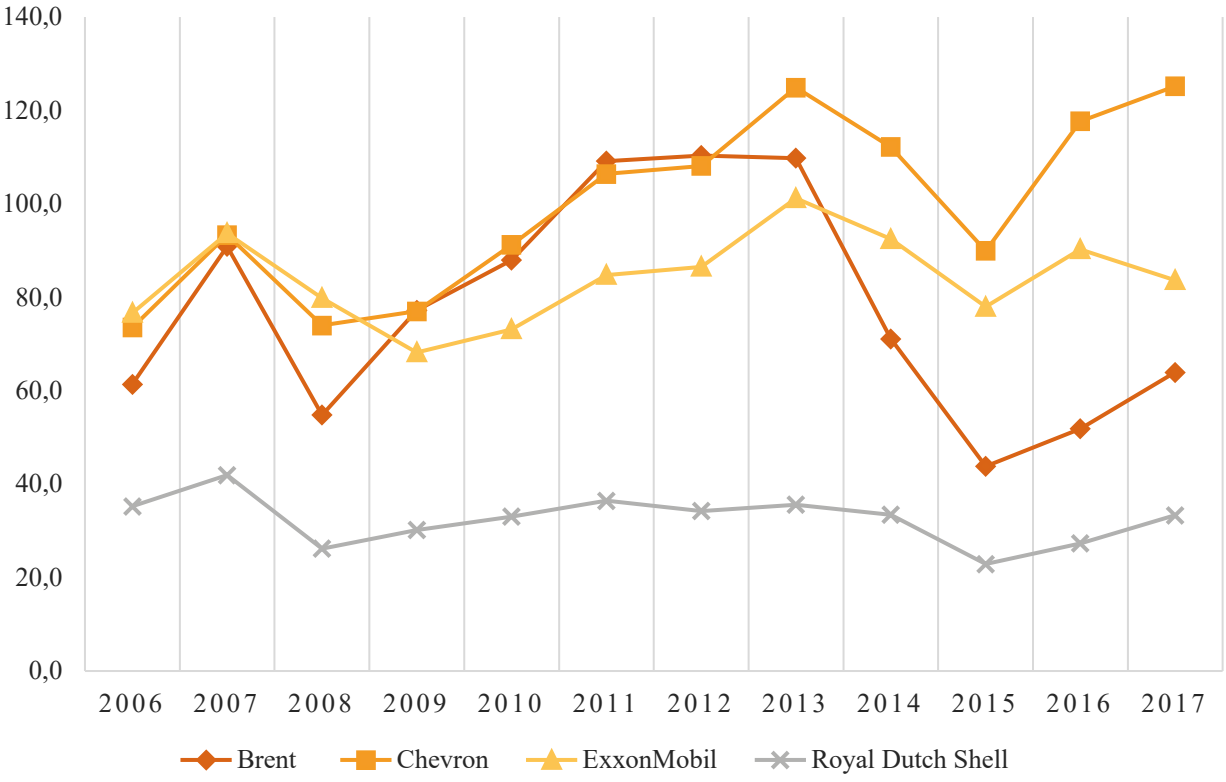
Table 3. Results of Econometric Study of the Pooled Regression Model and Fixed-Effects Model

	Model 1		Model 2	
Independent variables	Coef.	T	Coef.	T
ROE	24.962	0.56	22.2	0.68
Down_income	-.43	-0.72	-.24	-0.62
DPO	-1.02	-0.83	1.06	1.27
TobinQ	19.6	4.19***	18.6	4.63***
S_ratio	-123.1	-5.85***	-166.4	-4.93***
Prof_down	-41.02	-0.64	-54.9	-1.25
Prof_up	17.8	3.37***	5.6	1.57*
Cap_d	-32.31	-3.17***	-27.2	-3.93***
Purch_oil	-110.6	-7.87***	-33.9	-2.40**
M_A	-4.8	-1.66*	-1.07	-0.55
_cons	197.6	13.75***	161.2	8.28***

*** – the factor is significant at the 1% level of significance, ** – the factor is significant at the 5% level of significance, * – the factor is significant at the 10% level of significance.

Source: comprised by the author.

Figure 3. Prices for shares of some companies and Brent oil in the period of 2006 to 2017



Source: comprised by the author on the basis of the database of Thomson Reuters Eikon.

Table 4. Research Results

Hypotheses	Obtained results	Interpretation
1. Growth of income in the downstream segment has positive effect on security prices.	Growth of income in the downstream segment which was expressed as Down_income variable came to be insignificant, therein it should be noted that the assessment in the deterministic effects model and Spearman's correlation coefficient have the minus sign	Notwithstanding that companies improve their financial results owing to the downstream segment when oil price drops, the investors take a negative view of the fact of oil price decrease which makes them sell shares
2. Growth of profitability of sales in the upstream and downstream segments has positive effect on the price of companies shares.	Prof_up variable turned out to be significant at the 10% level of significance while Prof_down came to be insignificant, nonetheless assessments in the deterministic effects model (and other models) have the plus and minus sign respectively	Growth of profitability of sales in the upstream segment results in a rise in companies' share prices while growth of profitability of sales in the downstream segment is related to a drop in prices. The minus sign may be accounted for the fact that oil companies are especially actively involved with the downstream activity when oil price declines, such actions, though they lead to a drop in companies' share prices, mitigate such a drop
3. Increase of debt load decreases the share price	The debt ratio S_ratio turned out to be significant and, as we presumed, it has a negative effect on share prices	Increase of the debt ratio by 0.01 results in decrease of companies' share prices by 166 US dollars, all other conditions being equal
4. Increase of investment costs in the downstream segment has positive effect on the company capitalization	The investment costs in the downstream segment (Cap_d) turned out to be significant, the obtained assessment has the minus sign	Increase of investment costs in the downstream segment against the aggregate investment costs by 0.01 results in a drop in companies' share prices by 27 US dollars, all other conditions being equal
5. M&A deals influence the share prices	M&A variable turned out to be insignificant in the final model	Probably, the issue of influence of M&A deals on share prices should be studied in more detail using monthly data instead of quarterly data

Source: comprised by the author.

The following may be added to the results represented in Table 4:

- changes in the capital structure of large oil companies influence share price: debt growth leads to price decline;
- growth of investment costs in the downstream sector as compared to the aggregate investment costs has an adverse effect on the companies' value. It stems from the fact that when oil price declines large oil companies cut investment costs in the upstream sector simultaneously increasing the investment costs in the advanced petroleum refining sector;
- when Tobin's Q increases the price of shares of large oil companies grows. This suggests that investors are ready to invest their money in the shares of the companies which are overestimated from the market point of view as compared to the shares of other oil companies.

In order to promote the research of assessment of oil companies' value it is reasonable to carry out the analysis of influence of the considered factors not just on capitalization of the largest vertically integrated oil companies but also of the companies carrying out production separately in the upstream and downstream segments. This will let us describe in more detail and explain the obtained conclusions as well as to conduct the comparative analysis of the factors which influence oil companies conducting production in various segments.

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