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Negative Net Worth of Manufacturing Companies: Corporate Governance and Industry Expectations [1]

Abstract. Transparent and effective corporate governance positively influences the financial stability of the company: it increases the investment attractiveness and reduces the costs of lending. For Russia, this problem is relatively new. And at the moment, corporate management in the manufacturing industry continues to be characterized by a high concentration of ownership and a combination of ownership and management functions. In this paper, using logistic regression we investigate the impact of corporate governance factors and industry expectations on a negative net worth of the companies in the period 2011–2015. The results showed, in particular, the probability of a negative company's net worth is higher, the lower the index of business confidence in the industry; the presence of agency problem; the smaller the number of members in the board of directors; the higher ownership concentration; and, if company is not privately owned or joint-stock company in the manufacturing industry. Robustness of the coefficients of the final specification was confirmed.

1. Introduction

Transition to the innovation economy, where the human capital, as well as the knowledge and information, are the drivers of economic growth, advance progressively. These drivers are based mainly on the industrial economic development, on industry as the major growth driver. This harmonious symbiosis may be the platform for the stable economy in the long run. The manufacturing industry is the major element in the structure of the Russian industry in goods shipped of the own production and the average annual number of employees — about two thirds and three quarters correspondingly.

Decision of strategic tasks aimed at the transition of the economy to the road with high-technology components (at putting the economy on the rails with high-technology compartments) requires this road to be reliable and correctly oriented (these rails to be of high quality). Another words, they should keep up the drive of the breakthrough technologies and cope with driving pressure distribution (that is diversification of the economy). Railroad in this story is the effectiveness of Russian manufacturing industry. We cannot develop the diversification of economy and draw down the oil-gas development in the long-run.

According to RosStat, the share of manufacturing industry in the Russian economy is declining, but still it remains the most important sectors of economy: its gross value added in GDR (about 13.4% in 2011–2015) is less only than the trade and commercial services, while the number of employed (about 14.7% in the same period) is less only compared to trade. In the long run the competitive positions of manufacturing industries in the home and world markets are important components of the country's stability factors. Diversity in the manufacturing industries in location, size and behavior would contribute to the complex analysis of effectiveness of the present economic policies, as well as to designing the market institutions in Russia (Kusnetsov, 2014). In 2014–2015, at the close of the world financial markets, high volatility of the exchange rate, the rate of interest growth, as well as decrease of effective consumer demand and investment demand in the manufacturing industries we could observe monthly maximums of the bankrupts in some industries. There is multiple negative net worth of many companies, meaning multiple bankruptcies, or restructuring of businesses. Any crisis events allow us to observe the present situation in the industry through a system of risk management: new factors, tendencies, and the tectonic shifts if the market structure.

There are a number of foreign articles, where the authors made the estimates of bankruptcy expectations on the basis of different empirical data and the explaining factors. At the same time there are much less home researches of bankruptcy expectations, because the Russian authors have already made the estimates of the financial (Karminsky, 2009; Totmyanina, 2011; Salnikov et al., 2012) and macroeconomic factors (Peresetsky et al., 2011), as well as the factors related to technical efficiency (Mogilat, Ipatova, 2016).

Never the less, the Russian economic literature does not investigate the corporate governance as (1) a factor of financial stability, and (2) not a factor of bankruptcy but a factor of negative net worth of many companies, that often precedes a bankruptcy. Some fragment attempt of research of the connections between the factors of corporate governance with probability of bankruptcies were in concern of XVII International April conference on the problems of economic and social development (Fedorova et al., 2017).

The research of probability of the negative net worth of companies instead of probability of bankruptcies is a very special task. Not any negative net worth of companies leads to a company bankruptcy. Such an approach we get a chance to estimate the *starting point of coming company's problems beforehand* – another words — to see negative net worth of companies, but not the final point — that is decision of the arbitration court to declare the debtor bankrupt. In particular, the activities in banking sector (withdraw of the licenses from the banks) is a solid platform for the research of probability and the size of negative net worth of the companies (Mamonov, 2017; Karminsky, Kostrov, 2017).

Mass privatization of the 1990s revealed the weakness of the corporate governance mechanisms — and the dispersed ownership of the 'working collectives' (enterprises' collectives) was quickly changed by the high-concentrated ownership with no institutes of its rights' protection, weak stock market and no competitive management. The controlling shareholder became the leading actor, often participating in the corporate governance as the chief executive officer (CEO). The stimuli to create a new effective structure of corporate governance appeared much later, after 1998 crisis, when the economists understood, that the further business development would be based on international standards mobilizing the best practices. At the start the practice of corporate governance looked like improving company reputation and home business sustainability before the foreign investors (Pappe, 2012). Later, after the national stock market had developed, the economists realized that *optimal corporate structuring* could be an effective tool for corporate governance, providing the growth of income within the market economy.

In 2000s the planned improvement in regulating norms and mechanisms of enforcement to its implementation reduced the tension in corporate conflicts (Shprenger, 2012). In the mid-2000s a *model of co-owners' alliance* changed the model of individual ownership of big Russian companies': the explosive growth of leading companies made them too expensive for an individual owner. That is why diversification of investment capital was quite a natural trend (Pappe, Antonenko, 2011).

It is interesting to understand a role of corporate governance for the Russian companies in the manufacturing sector and its influence on the financial stability on the basis of the mentioned structural specifications.

We make a two-step evaluation of the probability of negative net worth of companies in the manufacturing sector: the basic model founded on the financial parameters, and the final model being founded on the additional factors of corporate governance and industry expectations.

The article has the following structure. International and national experience of corporate governance is analyzed in Part 2. There are the sources and characteristics of data and the algorithm of cleaning the samples in Part 3. In Part 4 we give a description of empirical research, which is a two-step evaluation of the probability of negative net worth of companies. Part 5 shows the regression estimates and the results of their stability testing. In the conclusion attention is focused on the principle conclusions on the structure peculiarities of corporate governance structuring of the companies in manufacturing sector, influencing their financial stability.

2. International and Russian experience of corporate governance analysis

We focus on the estimate of the probability of negative net worth of companies that is the negative net between the assets and liabilities of the companies. The articles on analysis of net worth of companies (NWC)

note that decrease in the companies' worth may provoke negative net worth of the companies, and this process depends on the amount and length of decline in gross output, price of the assets, as well as the quality of management (Chen, 2001). Negative net worth of the companies is a real market process, which takes place in the financially vulnerable companies, mainly on the periods of crisis. Negative net worth of the companies provokes their further restructuring, or bankruptcies (Mamonov, 2017).

Sometimes the companies, trying to keep its image, are concealing negative net worth of companies, produce fake financial accounting, as well as make the companies to function till the moment when defrauded investor would go to the arbitration court and start the bankruptcy procedure. But thorough study of this problem is not the author's priority.

The 2013 Central Bank (further CB) policy of cleaning the bank sector form unfair and unstable actors gave a secure (reliable) platform for the national research in modelling negative net worth of the banks (NNWB) (Mamonov, 2017; Karminsky, Kostrov, 2017). One of the earliest and noted articles in the subject in the foreign literature is the research of C. James, based on the American banking system data (James, 1991). One of the major trigger for the negative net worth are the risk operations of the banks as well as the macroeconomic instability, reducing the investment activities, aggregate demand and supply. These ideas make us understand that the negative effect from negative net worth of the banks may become the realization of the system risks of the borrowers.

But what influences the probability of the negative net worth of a company? First — the financial performance of a company and macroeconomic environment (solvent consumer and investor). But we can always find the persons taking the decisions behind the particular performances figures. The system of corporate governance may be a deposit either of its effective development in the market economy, or the reason of its stagnation.

One of the classic examples of good corporate governance importance is Enron affair — that is a collapse of the major and once the most innovative American energy company because of ineffective system of inside and outside activity control, as well as the agency problem (a conflict between the interests of managers and owners) (Jensen, 1986).

Modern researches note the necessity of thorough investigation in ownership structure changes and the problems of corporate governance in the Russian companies (for example, (Iwasaki, 2014; Dolgopyatova, 2016)).

The foreign authors stress three basic parameters that design the hypothesis on the influence of corporate governance factors on the company's financial stability: the characteristics of general manager, board of directors and ownership structure. General hypothesis on the role of value added of corporate governance factors in levelling-up the prognostic quality of the models were confirmed by the foreign authors (Ciampi, 2015; Liang et al., 2016). Let us note a special trend — the estimate of probability of general manager retirement because of company's poor financial perfor-

mances (example, (Bushman et al., 2010; You, 2012; Fiordelisi et al., 2014; Solncev, Pentuk, 2016)).

There are outside, as well as inside mechanisms of company control. The outside mechanism — to issue an initial public offering, meaning publicity and openness of corporate activities. The total holding of more than one office (general manager) by the major owners is the main tool of inside control over the company; it takes place because of poor national financial market development. Since 1990s this mechanism has wide spread — that is high ownership concentration (ownership dispersion was quickly concentrated in a small group of owners), poor corporate legislation and law enforcement procedures, as well as the agency problem (Kyznecov et al., 2014).

We can find several approaches to the analysis for the chairman of the board of directors (CEO-duality situation — in the foreign literature). Because of specifics of the joint-stock company's functioning in Russia[2], we shall test another factor — a combination of executive and control functions, when CEO-owner also takes the position of chief executive officer (CEO). We consider international experience very informative and useful for hypothesis on «CEO-owner» formulation.

Firstly, the mere fact of «CEO-duality» in the company may be taken by the market as empowering the CEO with unlimited authorities, that indicates bad corporate governance practices (for example, (Shailer, Wang, 2015; Daily, Dalton, 1994; Elloumi, Gueyie, 2001)). This fact be simultaneously become the reason for reducing company's credit rating (Ashbaugh-Skaife et al., 2006). Second, in case of combination of ownership and management there are no conflicts between the general manager and the owners — another words there is *no agency problem*. Third, director-co-owner would tightly connect his personal reputation to that of the company, enhancing some extra-stimuli for the company's stable development (Ciampi, 2015). Fourth, *X*-theory management style of the employees' motivation is found more often in Russia[3]. The managers are sure to continuously motivate the employees to work; they need a continuous supervision, because the employees do not want to take initiative and carry out their duties for the good of the company. On the contrary, management style, based on *Y*-theory, suppose the employees have the inner stimuli for self-control and self-management within the working process. And this drive is a reliable platform for nominating the outside CEO, whose motivation would differ from that of the workers' be only one point — personal material benefit. So, in most cases it is difficult to state trusting relationships with the chief executive officer.

So, the *first hypothesis* states: combination of ownership and government functions in our country may positively contribute to the financial stability of the company.

[2] According to Fed-Act-208 («Joint-stock companies») (26 December 1995): a person exercising the functions of single executive body (general manager), can not simultaneously be the Chairman of the Board of directors (Supervisory council).

[3] A prominent researcher in leadership, Douglas McGregor, proposed two contradicting theories on human motivation: theories «X» and «Y». The author himself noted that in theory «X» he saw the prerequisites of authoritarian management, as well as in theory «Y» — he saw the prerequisites of democratic management.

Hypothesis 1 (H1). *In case there is combination of ownership and* governance *functions (CEO-owner), there a probability of negative net worth of the company is much lower.*

The authors think, the problems of industry expectations influence on the financial stability of a company in the real sector, provided by the company managers, are hardly the subject of research (could not find the academic research articles). Still there is an assumption, that this factor may provoke the negative net worth of the companies and play a role of either *insight of the managers,* or as *self-fulfilling prognosis.* For estimating industrial expectations we took index of business confidence (IBC) as a proxy-indicator. For every manufacturing industry a monthly index was cleared of seasonality effects. Further, we proposed, that the next year expectations are created by the experts beforehand (for example, during the second half of the year). In the second half of the year (From August to December) the projects are being closed, the results of the year are formed (balanced), the budget (for the next year is made up) as well as the next year strategy. The average (mean) of IBC for the half of the current year will be responsible (adequate) for next year's industry expectations.

Hypothesis 2 (H2). *The higher* (*lower*) *are industry expectations of business managers, the lower* (*higher*) *is a probability of negative net worth of the company in the industries in concern.*

In the present research a number of business co-owners are a measure of ownership concentration, − those co-owners, who elect a Board of directors to represent their interests. The more varied are the interests, the greater a number of a Board of directors and the better the expert knowledge, probably, is necessary for successful company's management. Still more, such a measure of dispersed concentration of ownership (company's ownership is allocated between a number of co-owners) may provide a more effective supervision over manager's activities. Creating and estimating the company's executive bodies (including elections of the CEO), and monitoring the financial reports are the major functions of the Board of directors (Weisbach, 1988; Darrat, Gray, 2016).

Hypothesis 3 (H3). *Numerous owners decrease the probability* (*expectancy*) *of getting the negative net worth of a company.*

The analysis of ownership concentration is based on the following criteria: high level of ownership concentration − controlling block of shares with the owners' (> 50%); mean / average level of ownership concentration − the major owner possesses the controlling block of shares (more than 25%, but less than 50%); low level of ownership concentration − much dispersed ownership (all the owners possess less than 25%) (Dolgopyatova, 2010). In mid-2000s high ownership concentration was the immanent character of the Russian corporate sector. But with growing competition, improving the institutes and the quality of management the market motives were becoming the important for the most owners: profit-seeking, net worth

of the company's growth, and increasing the market share (Dolgopyatova, Ivasaki, Yakovlev, 2009). Competitiveness monitoring data[4] in the late 2000s shows the tendency of reducing ownership concentration in a number of enterprises. In 2005 a high level of ownership concentration was a characteristic of the ¾ of the enterprises, in 2009 it was marked only in 2/3 of enterprises. This level of ownership concentration could be seen in different industries, in the enterprises of various sizes, as well as in the listed and non-listed companies (Dolgopyatova, 2010). A multi-country study (La Porta et al., 1999) showed that dispersed ownership is not a rule. In our research we never the less assume, that high ownership concentration is the reason for high risks, and the higher the concentration, the higher are the risks of negative net worth of the company.

Hypothesis 4 (H4). *The higher ownership concentration, the higher the probability of negative net worth of the company* (*perhaps, there is a U-shaped dependence*).

So, in this article we also tested the influence of the forms of ownership and institutional-legal forms on the financial stability of the companies.

It is quite probable, that private business is more sensitive to negative net worth of the company, since poor investment attractiveness and failure in carrying out the liabilities, private business has much less resources for raising capitalization (as compared to the public companies). This idea may help organizing more careful risk-management in the private companies, not to get a negative net worth of the company. It is worth mentioning that public company may have a positive effect — a reduction of cost of capital eases the debt burden for a company, as the case for Chinese companies listed at the stock exchange (Shailer et al., 2015).

What theoretical conclusions can be drawn, if blocking shares (more than 50%) in the chartered capital belongs to the other company — that an institutional owner (Morrelec et al., 2012)? — On the ony hand, if the major owner generates profit by himself and possesses a share in the market, so he (it) may be considered a good guarantee in case of financial problems. But on the other hand, the weak point of this statement is the dependence and inflexibility of the affiliated companies because of their probably and not a priority position (by default), that may cause negative net worth of the companies.

The companies listed at the stock exchanges as a rule are characterized by dispersed ownership, being ready to follow the strategic behavior, as well as by better quality of management and using various management technologies, that (no doubt) strengthen their financial stability.

Study of these three ideas lays the basis for Hypothesis 5.

Hypothesis 5 (H5). *If a company is a private property, then negative net worth of a company is less expected. The affiliated companies* (*with owner – legal entity*) *in the ownership structure, a negative net worth of a company is more expected. If company is a joint-stock company*, *then negative net worth of a company is less expected.*

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[4] Questioning of 1000 enterprises in manufacturing industry with more than 100 employees, but not more than 10 000 employees (see in details (Dolgopyatova, 2010)).

2. Sampling for empirical research

The information basis was created using the following resources: database SPARK-Interfax, database Ruslan, database RosStat and Central Bank of Russia. The analysis of the Russian (example, (Grigoreva, 2013; Karminsky, 2015)) and the foreign (example, (Beaver, 1966; Altman, 1968; Ohlson, 1980; Shumway, 2001; Barboza et al., 2017)) articles on estimating the companies' risks allowed us to construct a variety of financial indicators.

All the explanatory financial variables were divided into seven groups: a size of a company, its profitability, liquidity, business activities, financial stability, unpaid debts and development dynamics (Karminsky, 2009; "SPAR-Interfax system"). This was done to get a clear picture and easy choice of a variable in each group with the best differentiating and predictive power. Since the aim of this article is to study the influence of corporate management and industry expectations on the financial stability of a company, we added two corresponding groups. The descriptive statistics of the explanatory variables (introduced into the final regression equations) can be found in Table 1.

One of the model parameters is a year time lag that is in accord with Basel Committee's on bank Supervision (BCBS) recommendations. This time interval is enough to take preventive measures. Factor analysis of negative net worth of the company is carried on the data on medium-size and big business[5] in manufacturing industries (Russian Classification of Types of Economic Activity (OKVED) − 15–37) for 2011–2015. A sample was cleared from the companies with missing data in the financial reporting. A range of explaining variables was further cleared from statistical outliers (99.5 and 0.5%). Sample consists of joint-stock companies and limited liability companies. Practically 70% of a sample is private business. A frequency of interesting us events within industries is at the acceptable level (not less than 7.0%). The exception is leather production and leather products, because in the period in question there was no negative net worth of the companies. Further analysis this branch will be connected to textiles and clothing manufacture (Table 2).

Methodology of prognostic model estimates requires dividing a general sample into two parts: instructive and control. The important criterion is a share of the event in question in such a sample. These shares are to be quite comparable, not to run across a problem of retraining. In our case the sample was divided into two types of division (Table 3). The optimal way of division was chosen using the established criterion: instruction of model took part in 2012–2014, testing (control) the model − in 2011 and 2015.

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[5] The companies, which sales income exceeded 400 mln rubles in 2011–2015.

Table 1
Descriptive statistics of the financial and corporate variables

Group	Variable	Description	Test on means equality	factor, NNW	Average value	Standard deviation	Median	Minimum value	Maximum value
Dependent variable	NNW (Negative Net Worth)	1 – if total assets are less than total liabilities, 0 – otherwise							
Size of a company	Size_R	Natural logarithm of sales revenue	*	1	14.37	1.04	14.18	10.65	19.07
				0	14.45	1.04	14.23	8.83	19.73
Profitability	ROA	Net profit / Total assets	****	1	−0.08	0.16	−0.04	−1.26	0.33
				0	0.07	0.11	0.04	−2.13	2.48
Development dynamics	D_ROA	A number of running years with negative ROA	****	1	1.67	1.78	1	0	8
				0	0.21	0.8	0	0	9
Liquidity	Net_working_capital	(Working assets − Short-term liabilities) / Total assets	****	1	−0.14	0.39	−0.09	−1.63	0.87
				0	0.2	0.26	0.19	−1.42	0.95
Business activities	Turn_assets	Assets turnover = Income / Total assets	****	1	1.6	1.55	1.13	0.08	12.01
				0	1.78	1.29	1.45	0.06	11.96
	Z_A_m	Z_A module, as Z_A < 0 – operation risks, and Z_A > 0 – approaching the bankruptcy	****	1	0.27	0.3	0.17	0	2.07
				0	0.18	0.16	0.13	0	1.87
Financial stability	Real_value	(Fixed assets + Stocks + Construction in progress / Total assets	****	1	0.64	0.22	0.68	0.01	0.98
				0	0.61	0.2	0.64	0	0.99
	ZB_A	(Loans (short-term) + Loans (long-term) / Total assets	****	1	0.63	0.39	0.67	0	2.49
				0	0.27	0.25	0.22	0	1.48
Unpaid debts	Lt_debt_ratio	Long-term liabilities / Total assets	****	1	0.41	0.42	0.31	0	2.49
				0	0.15	0.2	0.04	0	1.41

The ending of table 1

Group	Variable	Description	Test on means equality	NNW factor	Average value	Standard deviation	Median	Minimum value	Maximum value
	Private	1 – if Russian classification of forms of ownership (OKOPF) of a company is 16, 0 – otherwise	***	1	0.55	0.5	1	0	1
				0	0.7	0.46	1	0	1
	Number_ co-owners	Number of co-owners (in SPARK database – 10–11 major owners present)	***	1	1.78	1.41	1	1	10
				0	2.37	2.02	2	0	11
	CEO_owner	1 – it CEO is co-owner of a company (has a share in statutory capital), 0 – otherwise	***	1	0.05	0.23	0	0	1
				0	0.24	0.42	0	0	1
	Ownership_ concentration	Maximum ownership concentration in co-owners	***	1	0.85	0.24	1	0	1
				0	0.76	0.28	0.95	0	1
Corporate governance	*Low_ concentration*	1 – if maximum ownership concentration in co-owners does not exceed 25%, 0 – otherwise		1	0.04	0.19	0	0	1
				0	0.06	0.24	0	0	1
	Medium_ concentration	1 – if maximum ownership concentration of co-owners is 25–50%, 0 – otherwise	*	1	0.06	0.24	0	0	1
				0	0,13	0,34	0	0	1
	High_ concentration	1 – if maximum ownership concentration in co-owners exceeds 50%, 0 – otherwise	***	1	0.87	0.34	1	0	1
				0	0.76	0.43	1	0	1
	*High_ concentration*1	If there is major co-owner (> 25%)		1	0.09	0.29	0	0	1
				0	0.09	0.28	0	0	1
	*High_ concentration*2	No major co-owner (> 25%)		1	0.78	0.41	1	0	1
				0	0.67	0.47	1	0	1
	Inst_control	1 – if one legal entity > 50%, 0 – otherwise	***	1	0.42	0.49	0	0	1
				0	0.34	0.47	0	0	1
Industry expectations	*IPU_h*	(Business confidence index of the companies in manufacturing industries according two-letters indication in the Russian Classification of Types of Economic Activity (OKVED1) (from 2009), % mean for half a year	***	1	–2.47	3.4	–2.53	–11.33	3.33
				0	–2.02	3.34	–1.68	–11.33	3.33

Resource: SPARK-Interfax, filled by the authors.

Note. «*» – significance at 10% level; «**» – significance at 5% level; «***» – significance at 1% level.

Table 2

Sample structure and frequency of negative net worth of the companies across
the industries

Russian classification of forms of ownership (OKOPF) / Russian Classification of Types of Economic Activity (OKVED) 1	Signification	Number of companies (total)	Number of negative net worth	Event frequency, %
Public joint-stock company	*PAO*	555	36	6.5
Non-public joint-stock company	*NPAO*	729	79	10.8
Limited liability company	*OOO*	1411	186	13.2
Private ownership	*Private*	1853	166	8.9
Foreign ownership	*Inostr*	444	95	21.4
Food, including beverage and Tabaco	*DA*	716	75	10.5
Textile and clothing industry	*DB*	47	4	8.5
Leather production, leather products and shoes	*DC*	7	0	0
Timber and wood products	*DD*	66	9	13.6
Pulp and paper production; publishing and printing	*DE*	108	15	13.9
Coke industry, oil-products and nuclear materials	*DF*	61	9	14.8
Chemical industry	*DG*	238	18	7.6
Rubber and plastic production	*DH*	148	17	11.5
Production of other non-metal mineral products	*DI*	229	28	12.2
Metallurgy and manufacture of metallurgic complete products	*DJ*	321	43	13.4
Machine and equipment production	*DK*	253	26	10.4
Electrical equipment, electronic and optical equipment	*DL*	257	21	8.2
Production of vehicles and equipment	*DM*	195	31	15.9
Other productions	*DN*	54	5	9.3

Resources: SPARK-Interfax, filled by the authors.

Table 3

Instructive and control samples of the frequency of negative net worth of a company[*]

Parameter	Year					Instructive sample No.1 (2011–2014)	Instructive sample No.1 (2015)	Control sample No. 2 (2012–2014)	Control sample No. 2 (2011 and 2015)
	2011	2012	2013	2014	2015				
Negative net worth of a company	91	87	103	167	161	448	161	357	252
Number of observations	2427	2499	2612	2610	2603	10 148	2603	7721	5030
Event frequency, %	3.8	3.5	3.9	6.4	6.2	4.4	6.2	4.6	5.0

Resources: SPARK-Interfax, filled by the authors.

[*] Sample No. 1 is divided into 80: 20% — according to the observations, and into 75: 25% according to the events. Sample No. 2 is divided into 60: 40% accordingly.

4. Research methods (empiric design)

We use logistic regression to make prognosis of the probability of negative net worth of a manufacturing company (Ohlson, 1980). At step one we estimate a probability of negative net worth of a company with a number of explanatory variables:

$$P\{NNW_{it+1} = 1\} = \left(1 + \exp(\alpha_1 + \sum_{L=1}^{L}\beta_{1,l}Finance_{l,it} + \varepsilon_{1,it+1})\right)^{-1}, \quad (1)$$

where i – company index, t – year, $Finance$ – a number of explanatory financial variables.

At step two one by one we include the factors of corporate governance and industry expectations of the companies' directors:

$$P\{NNW_{it+1} = 1\} = \left(1 + \exp\left(\alpha_2 + \sum_{L=1}^{L}\beta_{2,l}Finance_{l,it} + \sum_{M=1}^{M}\gamma_{2,m}CorpGov_{m,it} + \varepsilon_{2,it+1}\right)\right)^{-1}, \quad (2)$$

where $CorpGov$ – a number of corporate governance factors.

Change of model quality after including additional factors is examined on the basis of comparison the prognostic power of the models' indexes (AUC and mistakes of type I and II).

Binary choice models are tested with the help of maximum likelihood method (Bluhm et al., 2010). Among the advantages of logit-model we notice a possibility of accounting different factors influencing the negative net worth of the company (or default probability (Merton, 1974)), hierarchical character, simplicity of economic interpretation and further model use. This class of the models is distinguished by possible correlation between the results and a sample (effect of retraining). That is why the final specification of the model was tested for coefficient stability (signs and significance). The essence of the method is the interactive estimate of the coefficients of the final model specifications; at every step (out of 1000) the coefficients are estimated for random creation of instructive and control samples as 75 and 25% correspondingly.

To find multicollinearity we use a coefficient of increasing variance inflation factor's (VIF) dispersion; its meaning should not exceed 5 to make sure that such a problem is absent (Zuur et al., 2010). Let us note, that dependent variable of the model with one year lag is explained by the financial and corporate parameters. In this statement there is no idea of endogeneity.

Further implications of the model is projected for the new data; that is why the prognosic quality of the model is to be better tested on the control sample for mistakes type I (goal skipping) and type II (false alarm) (Kaminsky, Reinhart, 1999). The the cut-off point is cleared in the process of arithmetic mean minimization of type I and II mistakes. The evident quality of the final model in the work is presented by area under ROC-curve (AUC); the values higher than 0.8 mark the perfect quality of the model (Pomazanov, Petrov, 2008).

5. Economic analysis of the empirical results

According to the above described methodology the basic model of probable negative net worth of the company using the financial variables was tested at the first step (Table 4).

Table 4

Regression results (basic logit-model): explanation of negative net worth of the company probability only though the financial factors

No. pp.	Group	Explanatory variables (lag = 1 year before negative net worth of the company in accounting department)	logit-model (dependent variable − *NNW*)	
1	Size of a company	*Size_R*	−0.21*** (0.07)	
2	Profitability (return on assets)	*ROA*	−4.24*** (1.01)	
3	Liquidity	*Net_working_capital*	−6.34*** (0.37)	
4	Business activities	*Z_A_m*	1.55*** (0.36)	
5	Financial sustainability	*Real_value*	−4.44*** (0.41)	
6	Debt load	*Lt_debt_ratio*	6.59*** (0.37)	
7	Dynamics of development	*D_ROA*	0.18*** (0.05)	
Dummy variables for the years			+	
Dummy variables for the industries (*DA* − basic industry)			+	
Dummy variables for Federal districts			−	
Dummy variables for creating the company period			−	
Constant			0.14 (1.09)	
Prognostic variables			In-sample (2012–2014)	Out-of-sample (2011 and 2015)
Number of observations			7721	5030
Number of events in the sample			357 (4.6%)	252 (5.0%)
Log *Likelihood*			−835.74	
Akaike Criterion			1717.48	
Area under ROC-curve (AUC)			0.905	0.912
Type II mistake "False alarm"			0.166	0.164
Type I mistake "Goal skipping"			0.171	0.160
Mean mistake			0.168	0.162
Cut-off point*			0.0543	0.0425

Resources: Filled by the authors.

Note. «*» − significance at 10% level; «**» − significance at 5% level; «***» − significance at 1% level.

Statistically significant explanatory variables of the basic (underlying) model have the expected signs); all these demonstrate high prognostic quality — parameter AUC equals 0.905 and 0.912 for intra-sample and out-of-sample prognosis correspondingly. Average error of prognosis is about 16.5%, which is considered a good result.

We consider classic the variables in the basic (underlying) model. It is necessary to note, that net accounts payable (creditors' debt) is likely to be considered as an absolute value (module accuracy): much less than zero value is followed by the operational risks, but a value much greater than zero is followed by late payments. A special parameter of profitability is responsible for the dynamics of company development: a number of years before the report date, when profitability is in the negative zone. It is clear, that in case of losses a company is difficult to find the reserves for the further conduct of business. Let us note in addition, that the estimates for the basic (underlying) model appeared likely for the companies of any age: dummy-variables turned to be insignificant for the period of company foundation. We could not confirm the statistical significance of geographic location of manufacturing enterprises — dummy-variables for the federal districts turned to be insignificant. Nevertheless, dummy-variables were accounted by including dummy-variables for industry (basic industry — food industry) and dummy-variables for years (basic year 2011).

After basic (underlying) model estimate we start testing hypothesis on the influence of corporate management on the financial stability of the companies in manufacturing industries by including the parameters of every one out of five. The empiric results (Table 5) turned to be quite interesting and effective. The entire hypothesis (that found statistical support) significantly improved the prognostic quality of the basic (underlying) model: AUC was higher, and the average prognosis mistake turned to be less.

The combination of executive and control functions, when CEO-owner also takes the position of chief executive officer (CEO) — a characteristic feature of manufacturing enterprises — was confirmed by the statistics with in the first hypothesis with "minus" (positive effect). This fact is likely to characterize deep-rooted specificity of a structure of inner corporate management — that is full combination (overlap), being the consequence of weak institutes, aimed at protecting the ownership rights in 1990s, and providing solution of agency problem. So, if an owner of manufacturing enterprise is also chief executive officer (CEO), then a probability of negative net worth of such a company is lower (Table 5).

Index of entrepreneur confidence, which we used as a proxy-variable for industry expectations, turned to be quite significant and had the expected sign. So, we could confirm the *second hypothesis*: the CEO could to some extend predict negative market conditions in the industry in concern. Let us note, that the higher the industry expectations (IBC), the lower probability to get negative net worth of the companies in the industries in concern.

Table 5

Hypothesis test: corporate expectations and corporate management influence on the probability of negative net worth of the company

Explanatory variables (lag = 1 year)	H1	H2	H3	H4 (I)	H4 (II)	H4 (III)	H4 (IV)	H4 (V)	H5 (I)	H5(II)	H5 (III)
H1 — *CEO_owner:* 1 – если генеральный директор является совладельцем компании, 0 – otherwise	−1.24*** (0.28)										
H2 — *IPU_h:* IBC (half a year)		−0.19*** (0.04)									
H3 — *Number_co-owners:* number of major company owners			−0.11** (0.05)								
H4 (I) — *Ownership_concentration:* maximum share among shareholders				0.68** (0.27)							
H4 (II) — *Low_concentration:* 1 – if maximum share among shareholders is ≤ 25%. 0 – otherwise					−0.11 (0.33)						
H4 (III) — *Medium_concentration:* 1 – if maximum sharer among shareholders is within 25–50%. 0 – otherwise						−0.53* (0.27)					
H4 (IV) — *High_concentration:* 1 – if maximum share among shareholders is ≥ 50%. 0 – otherwise							0.39* (0.22)				
H4 (V) — *High_concentration_2:* 1 – maximum share among shareholders ≥ 50% and major owner ≥ 25%. 0 – otherwise								−0.04 (0.20)			
H5 (I) — *Private:* 1 – private ownership. 0 – otherwise									−0.59*** (0.15)		

Explanatory variables (lag = 1 year)		H1	H2	H3	H4 (I)	H4 (II)	H4 (III)	H4 (IV)	H4 (V)	H5 (I)	H5 (II)	H5 (III)
H5(II)	*Inst_control:* 1 − if *legal entities* with shareholding are > 50%. 0 − otherwise										0.21 (0.14)	
H5 (III)	1 − joint-stock company. 0 − otherwise											−0.35** (0.14)
Basic model (financial parameters)		+	+	+	+	+	+	+	+	+	+	+
Constant		0.88 (1.08)	0.04 (1.07)	0.23 (1.07)	−0.48 (1.08)	0.04 (1.06)	0.12 (1.07)	−0.28 (1.08)	0.06 (1.07)	0.92 (1.08)	0.18 (1.07)	−0.19 (1.06)
Dummy-variables for industry (*DA* − basic industry)		+	+	+	+	+	+	+	+	+	+	+
Number of observations		5030	5030	5030	5030	5030	5030	5030	5030	5030	5030	5030
Number of events in a sample		252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)	252 (5.0%)
Akaike Criterion		1710.44	1734.90	1729.60	1730.54	1736.78	1732.83	1733.42	1736.85	1720.95	1734.61	1730.58
AUC (area under *ROC*-curve)		0.943	0.942	0.942	0.942	0.910	0.943	0.942	0.911	0.941	0.907	0.942
Type I mistake «Goal skipping»		0.157	0.109	0.114	0.104	0.149	0.103	0.104	0.150	0.142	0.160	0.095
Type II mistake «False alarm»		0.099	0.143	0.135	0.151	0.173	0.142	0.142	0.173	0.123	0.181	0.151
Average mistake		0.128	0.126	0.124	0.128	0.161	0.123	0.123	0.161	0.133	0.171	0.123
Cut-off point*		0.0838	0.1194	0.1159	0.1266	0.1201	0.1256	0.1257	0.1203	0.0943	0.1183	0.1378

Resource: Filled by the authors.

Note. «*» – significance at 10% level; «**» – significance at 5% level; «***» – significance at 1% level; in the round brackets are the robust standard mistakes; dependent variable − *NNW.*

The results of testing the *third hypothesis* on the significance of a number of co-owners give the ability to state: the specific features of inside corporate control of the company are effective for proving its stable development within market economy. So, in 2012–2014 the following fact was confirmed: the more there are major co-owners; the lower is the probability of financial instability of such a company in manufacturing industry.

The results of testing the *fourth hypothesis* demonstrate that in 2011–2015 high concentration of the ownership in the manufacturing industries negatively influenced the negative net worth of the companies, the higher is a share of business concentration, and the higher is a probability to get negative net worth of the company. The similar effect was obtained by including the continuous value of ownership concentration (from 0 to 100%), as well as the dummy-variable influencing the high ownership concentration (majority ownership). Nonlinear (or U-shape) correlation between financial stability and level of ownership concentration was not clearly confirmed. Probably, there is an indirect confirmation of this very fact: dummy-variables of high (sign "+") and average concentration (sign "–"). Though dummy-variables of low concentration turned out to be of low statistical significance, a return to significantly dispersed ownership is hardly possible on our corporate market.

The reason for it is a negative experience of the 1990s, when the dispersed ownership of working collectives after privatization quickly led to diminishing the minorities' rights. It is quite probable, that the Russian corporate market now understands that high ownership concentration may carry additional risks. And an effective compromise may be here an average level of concentration of the ownership (with the maximum share of the ownership is 25–50%). Let us note in addition that if a form of ownership is CEO-co-owner (with the controlling and blocking share) did not get a significant statistical support for negative net worth of the company.

The *fifth hypothesis* tested the specific features of ownership, and legal and organization forms. Our calculations showed private business working in the market are better managed, than the public companies. It can be traced in lower probability of negative net worth of the company. Expected negative influence of correlation with the legal entities (controlling share) did not find confirmation in our present research. Let us add that joint-stock companies are more open, more financially stable, than limited liability companies.

Our results were verified on stability with cross validation. To do this one of the possible final specifications were found concerning multicollinearity and simultaneous significance factor of explanatory variables: corporate management and industry expectations' factors were added. The coefficients were found stable (Table 6). For example, the variable "*CEO_owner*" was found significant with sing "minis" at every of 1000 steps. In 100% cases the sings at the coefficients of all the explanatory variables remained the same; while their signs were confirmed not less than in 97% of cases.

Our computation show, that the models' prognostic quality for different samples remains very high: minimum AUC = 0.906, maximum AUC = 0.962.

In that way, we received the confirmation of factor analysis of corporate management and industry expectations using the statistics, when studying the probability of negative net worth of the Russian manufacturing companies.

Table 6

Final logit-model specifications (*NNW* − dependent variable)

Explanatory variables (lag = 1 year before negative net worth of the company in financial reporting)	Logit-модель				Marginal effect	VIF (Variance inflation factor)	Sign	Value
Size_R	-0,23*** (0,07)				-0,001	1,17	(−) 1000	999
ROA	-3,81*** (1,00)				-0,024	1,43	(−) 1000	1000
Net_working_capital	-6,25*** (0,37)				-0,039	2,51	(−) 1000	1000
Z_A_m	1,78*** (0,37)				0,011	1,28	(+) 1000	1000
Real_value	-4,37*** (0,41)				-0,027	2,15	(−) 1000	1000
Lt_debt_ratio	6,44*** (0,37)				0,040	2,69	(+) 1000	1000
D_ROA	0,13** (0,05)				0,001	1,55	(+) 1000	971
IPU_h	−0,20*** (0,04)				−0,001	2,33	(+) 1000	979
CEO_owner	−1,13*** (0,28)				−0,005	1,05	(+) 1000	1000
Private	−0,48*** (0,15)				−0,003	1,14	(+) 1000	980
Константа	1,51 (1,09)				0,009		(+) 901	23
Dummy-variables for industry (DA – basic industry)	+				+	+	+	+
Dummy-variables for Federal districts	−				−	−	+	−
Dummy-variables for the company foundation period	−				−	−	−	−
Prognostic quality (in-sample and out-of-sample prognosis)	In-sample (2012-2014)	Out-of-sample (2011 и 2015)	Out-of-sample (2011)	Out-of-sample (2015)	Cross-validation: 0,75 (training) / 0,25 (test)		AUC (1000 steps)	Gini (1000 steps)

The ending of table 6

Explanatory variables (lag = 1 year before negative net worth of the company in financial reporting)	Logit-модель				Marginal effect	VIF (Variance inflation factor)	Sign	Value
Number of observations	7721	5030	2427	2603	Maximum value in 1000 regressions		0,962	0,924
Share of event in a sample	357 (4,6%)	252 (5,0%)	91 (3,8%)	161 (6,2%)				
Log Likelihood	−826,95				Minimum value in 1000 regressions		0,906	0,813
Akaike Criterion	1701,89							
Area under *ROC*-curve (AUC)	0,935	0,942	0,933	0,945				
Gini	0,870	0,884	0,867	0,890				
Type I mistake «Goal skipping»	0,19	0,09	0,12	0,09	Average value in 1000 regressions		0,934	0,867
Type II mistake «False alarm»	0,08	0,17	0,15	0,12				
Average mistake	0,14	0,13	0,14	0,12				
Sensitivity	0,81	0,91	0,88	0,91	Median value in 1000 regressions		0,934	0,868
Specificity	0,92	0,83	0,85	0,85				
Порог отсечения[*]	0,0855	0,0767	0,0698	0,1083				

Resource: Filled by the authors.

Note. «[*]» — significance at 10% level; «[**]» — significance at 5% level; «[***]» — significance at 1% level; in the round brackets are the robust standard mistakes; in the round brackets − standard robust mistakes.

6. Conclusion

One of the major steps to the effective market economy is considered to be the introduction of high quality corporate governance at the national companies. These factors are supposed to stabilize the investment climatey and invite investment for successive economic growth. The system of corporate governance in Russia is on the march. That is why the efforts of the government and the state are to enhance its development.

In our article we modeled the probability of negative net worth of the company related to the factors of corporate governance and industry expectations of the companies' directors. We used the national and foreign experience of financial stability and structural effects of corporates' governance studies to design the models. We proposed new hypothesis give a possibility to test the influence of the variables in question on the probability of negative net worth of the company. In particular, we formulated hypothesis 1 — about CEO-co-owner, hypothesis 2 — about industry expectations, hypothesis 3 — about number of co-owners, hypothesis 4 — about high ownership concentration, hypothesis 5 — about financial stability and joint-stock company. To test every hypothesis we proposed the variables, which we tested in the logistic regressions, along with the classical financial parameters.

We created a sample with medium and big companies in the Russian manufacturing industries for 2011–2015 for our research.

The results of our research show, that corporate governance has additional value in explaining the financial stability of the companies. We confirmed the robust qualities of the resulting estimates (signs and values of the logistic regression coefficients).

The most interesting corporate effects are:

- if one of the owners of a company was at the same time CEO, then probability of negative net worth of the company was lower (elasticity −1.24);
- the higher the index of entrepreneurs' (business) confidence in the industry, the lower a probability of negative net worth of the companies (elasticity −0.19);
- the more the number of co-owners, the lower a probability of negative net worth of the companies (elasticity −0.50);
- the higher ownership concentration, the higher a probability of negative net worth of the companies;
- if a company has an average level of ownership concentration, the lower a probability of negative net worth of the companies;
- if a company is a private ownership or a joint-stock company, the lower a probability of negative net worth of the companies.

One of the directions of the further analysis of negative net worth of the companies (similar to the banking sector) should be the analysis and prognostics of their value, including the case when negative net worth of the companies is concealed in fraudulent financial reporting. This new task will make us understand, which factors influence not only the expected risks of counterparty's losses, but also the value of potential losses. Another interesting task is a study of specificities of negative net worth of the companies in the disaggregated industry profile (through the manufacturing industries).

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