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Statistical Analysis of Assigning a Corporate Credit Rating with Regard to the Sovereign Rating in the Russian Federation

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Abstract

The paper presents the results of a statistical study of the formation of a corporate credit rating, with regard to the sovereign rating. The research is based on the data from 19 non–financial companies in Russia's leading industries for 2014–2018. It is shown that the sovereign credit rating, despite the relaxation of the sovereign "ceiling" rule by Fitch, Moody's and S&P rating agencies in 1997, remains closely correlated to the risk level of Russian companies. The obtained results related to macroeconomic and idiosyncratic risk indicators denote the peculiarities of credit rating formation for Russian companies. In particular, in contrast to the results of similar studies, it reveals the negative effect of certain profitability and liquidity variables, as well as the country's foreign trade turnover on the corporate rating. It also demonstrates that a credit rating has a "short memory" – its current value is historically determined only by the level in the previous period.

This paper is of practical relevance for private and institutional investors and lenders that use credit ratings to form their own perception of the default risk level in the corporate sector.

Keywords: credit ratings, sovereign ceiling, sovereign risk, corporate risk, risk transmission

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Introduction

According to methodology used by Fitch, Moody's and S&P rating agencies, corporate credit rating is defined on the basis of internal and external factors of the environment in which a company operates [1]. At the same time, the sovereign rating, along with characteristics of financial and operating performance and macroeconomic indicators, remains the key determinant of the corporate credit risk level. Corporate default risk may increase due to changes in sovereign rating, which contributes to the aggravation of negative processes in corporate financial and operating performance, and not due to the impairment of a company's fundamental indicators [2–5]. According to a vivid expression in [6], corporate credit rating is "contaminated" with sovereign risks. It is of special importance for the companies from emerging economies, including Russia, because for them the sovereign rating is a negative externality that increases the cost of borrowing and decreases capital inflow from private and institutional investors. In this paper we present the results of econometric modeling of the influence of corporate credit rating formation factors for Russian companies from the leading industries with regard to the sovereign rating.

Credit Rating: Definition, Measuring, Status of Studies

Credit rating is a comprehensive assessment of the subject's (a country or a company) status in terms of its creditworthiness, financial reliability and stability. Investors may use the credit rating when making investment decisions. However, it does not guarantee the expediency of cash investments because it is indicative of only one aspect of the borrower's standing – its creditworthiness [7]. The sovereign rating is often a reference point for raising investment in the public and private sectors, especially when debt is denominated in a foreign currency and traded in the international capital market. There are at least three channels for transferring the sovereign's credit risk to the private sector [8]. First, it is the destabilizing effect on the entire national economy, which may manifest itself as the strengthening of the public sector, capital outflow and an increase in the number of bankruptcies and liquidations of private financial and non-financial organizations. Second, a change in country risks is caused by government measures that directly determine the companies' ability to discharge their financial obligations, such as increased taxes or application of inflationary finance methods. Third, administrative measures which impose control over capital flow, including a partial or complete ban on currency trading for the corporate sector. The first two channels may demonstrate a direct connection between the corporate and sovereign ratings, however, they do not constitute proof that companies cannot have a credit rating that exceeds the sovereign rating. The last channel is used by Fitch, Moody's and S&P international rating agencies to substantiate the existence of the sovereign "ceiling". According to the policy of rating agencies, the sovereign "ceiling" exists due to the presence of direct (transmission) risk of government intervention for financial obligations in a foreign currency and due to the indirect sovereign (country) risk for financial obligations in the national currency. Direct risk is the probability that a government experiencing difficulties with servicing a foreign debt will impose restrictions on its repayment and even force solvent companies to suspend liability repayments in a foreign currency. Indirect risk is the risk of default on government debt denominated in national currency, which may be caused by the crash of a systemically important bank, among other things.

In 1997 the S&P agency loosened the sovereign "ceiling" policy in regard to the "dollarized" economies of Argentina, Panama and Uruguay. The reason for this step was that the government in highly dollarized countries is less prone to foreign exchange control in case of default on government debt, hence, its influence on corporate creditworthiness is minimal [9]. In 2001 the second wave of the "ceiling" rule relaxation took place after the experience of the zero transmission risk in Russia (1998), Pakistan (1998), Ecuador (1999) and Ukraine (2000) was analyzed. Moody's explained that credit rating assignment process was changed because, as a rule, governments do not impose restrictions on foreign currency payments for systemically important borrowers whose default would significantly damage the national economy [10]. In spite of the relaxation of the rule, corporate credit ratings that exceed the "ceiling" are still common [11].

The first credit ratings were assigned to emerging countries in the 1990s, when their debt instruments were offered at the global capital market for the first time. A sovereign credit rating is an important prerequisite for success in engaging foreign creditors on attractive terms. Without such a rating, investors automatically combine the maximum possible country risk and the risk premium, thus adding to the cost of debt servicing. The methodology used by Fitch, Moody's and S&P involves a two-stage assessment of sovereign credit risks [12; 13]. At the first stage, they evaluate the following factors: efficiency of the checks and balances system, power legitimacy, existence of civil society, mass media independence, diversification potential of the economic structure, economic growth prospects, national currency status in international payments, net public debt level. as well as flexibility of fiscal and monetary policy. Then the rating they have initially assigned is adjusted with regard to the country's credit reputation, its membership in a currency union, existence of highly liquid financial assets and degree of population confidence in the implemented monetary policy, which determined the possibility of applying unconventional monetary instruments during economic crises [1].

For the first time the issue of the sovereign "ceiling" was discussed in paper [14], which aimed to study whether the sovereign "ceiling" rule was used by investors in shaping their opinion on the borrower's credit risk level. The authors focus on the comparison of spreads of corporate and sovereign Eurobonds issued in emerging countries. An analysis showed that on average corporate debt is trad-

ed with a wider spread. In point of fact, it is indicative of implementing the sovereign "ceiling" policy when making investment decisions. Nevertheless, this result is sometimes incorrect. Narrow spreads of corporate Eurobonds are characteristic of the companies that profit from a large export base. A similar approach was applied in research [15]. The authors compared income of Southern African corporate and sovereign bonds denominated in the national currency and revealed that sovereign risk is a key determinant of the corporate risk premium level. The sovereign "ceiling" was exceeded only by several international corporations from the real sector of economy, while all Southern African financial companies failed to exceed it.

Papers [16; 17] study the influence of sovereign credit rating changes on changes in the credit ratings of banks and non-financial organizations. The methodology applied by Ferri et al. [16] is based on building a VECM model, which is used to detect a statistically significant positive correlation between corporate and sovereign ratings. The sovereign "ceiling" effect is most significant in emerging countries and in case of a decrease in the country credit rating. The model offered in research paper [17] was expanded by adding idiosyncratic risk indicators. The analysis results showed that unlike the sovereign rating, individual risk indicators are not significant factors in defining the default risk level.

The consequences of the 2007–2009 crisis resulted in impaired sovereign ratings in both emerging and developed economies. Thus, for the first time ever, the credit ratings of the USA and France dropped below "AAA". The issue of influence of the sovereign rating and the "ceiling" gained greater relevance again. Mohapatra et al. [18] compared credit ratings of corporate and government Eurobonds of emerging countries and concluded that only securitized bonds were able to exceed the sovereign "ceiling". However, the credit ratings of Eurobonds of non-financial companies issued during a crisis are largely correlated with the sovereign rating. So, it is impossible to obtain a rating which exceeds the country rating. The sovereign "ceiling" effect manifests itself most clearly in the countries with an authoritarian political regime and in connection with financial companies and their debt issuance. The latter is due to the fact that the real sector of economy has a lower average probability of default because of its right to raise prices during periods of decline in order to maintain the required solvency margin [19]. Influence of the sovereign rating is sustained and is observed even after taking into consideration individual and macroeconomic risk indicators.

The S&P rating agency considers the sovereign credit rating a two-stage assessment of quantitative and qualitative indicators that characterize economic and political stability in a country. However, the results of research [20] demonstrate that approximately 90% of the sovereign rating variation assigned by Moody's and S&P are actually due to macroeconomic indicators only. The significant factors include inflation, fiscal balance, current account, GDP growth rate, income per capita, country's debt/export ratio, dummy variables that determine the level of economic development and cases of national debt restructuring since 1970.

Conclusions made by R. Cantor and F. Packer [20] were used in this paper [8]. The authors showed that the extent of influence of the sovereign "ceiling" varies depending on the country's and industry sector's development levels. The nontraded sector of emerging countries, with cash flows usually denominated in the national currency, experiences the most significant pressure of the sovereign "ceiling". There is asymmetry of influence: the effect of the decreased sovereign credit rating is more significant for the corporate sector.

The credit rating of a company directly establishes the amount and cost of raising debt capital [21; 22], thus determining its financial and investment decisions [23–27]. This issue is considered in detail in paper [28]. The research objective was to demonstrate that changes in financial and investment policy may proceed from credit rating changes, not necessarily from fundamental company characteristics [29]. The sample was divided into the treatment and control groups[1]. According to the analysis results, in the year when the sovereign rating decreases, investments in the treatment and control group are reduced by 8.9 and 2.6% respectively. In the same period the treatment group decreases the issue of net liabilities by 5.1%, and the control group – by 2.3% [30]. Increased costs of debt servicing force the companies in the treatment group to make a statistically and economically significant increase of capital issuance the next year after the decrease of the sovereign rating. The reduction in investments and debt financing is the net effect of the impaired sovereign rating because both groups had similar dynamics for two years after its decrease.

The assertion made by rating agencies that sovereign credit rating is effective in forecasting government debt default [10], is not quite correct. For instance, international agencies faced criticism because they had failed to predict the Asian crisis (1997–1998), the crisis in Uruguay (2002) [31], and later – the global crisis of 2007–2009 [32]. The past experience of underestimating default resulted in the procyclical nature of credit ratings, i.e. their ability to aggravate economic and financial crises due to their excessive pessimism [3; 33; 34].

As for Russian literature, papers [1; 35–38] provide the most detailed analysis of credit rating formation for industrial companies. The authors' approach consists in the sequential study of the basic (only individual financial indicators) and supplemented (micro- and macroeconomic variables added) probit models of multiple choice with

[1] Treatment group comprises corporate issuers whose rating is not lower than the rating of their jurisdiction's sovereign.

Control group consists of corporate issuers whose fundamental indicators are close to those of the companies from the treatment group, however, their corporate rating is lower than the sovereign rating.

Huber-White standard errors. The sample comprised oil and gas, power-generating, iron and steel companies, and telecommunication carriers from developed and emerging countries. The results showed that statistically and economically significant quantitative determinants that have a positive impact on a company's creditworthiness are its market capitalization, return on assets, operating income margin and gross profit relative to short-term debt, i.e. the ability to generate cash flows sufficient to repay current liabilities [35]. The ratio of the volume of long-term obligations to capital, which characterizes the amount of loans and their security, has a significant adverse impact on the corporate credit estimate. According to the supplemented model, such environmental factors as GDP growth rate and openness of the economy contribute to a significant improvement of corporate credit ratings, while inflation decreases them [1]. The corruption level in a country has a negative, although unstable effect on corporate creditworthiness [38]. Paper [39] studies the role of qualitative characteristics of a borrower's activity: an industry's growth prospects, competitive performance, commercial goodwill, extent of dependence on government subsidies, corporate governance structure and its geographic diversity, which, as a rule, are used as adjusting indicators. It showed that the value of qualitative indicators increases greatly for corporate speculative-grade borrowers.

Thus, the results of previous research papers show that the sovereign rating is a significant factor in the corporate creditworthiness level in different countries. The extent of interrelation between the sovereign and corporate ratings depends on a country's development level, its political regime, economy sector and type of company's activities. Asymmetry of the country "ceiling" effect is observed: the influence manifests itself most prominently when the sovereign credit rating is decreased, as well as for the companies whose credit rating is not below the sovereign rating.

The objective of this paper is to define the extent of influence of the primary rating formation factors on corporate credit rating formation with regard to the role of the sovereign rating. The following hypotheses are among the main verified assumptions:

- There is a statistically significant direct relationship between the corporate and sovereign credit ratings of Russian companies;
- Financial independence indicators of companies have a positive impact on the formation of their credit rating;
- Economic efficiency indicators have a positive impact on companies' creditworthiness;
- Liquidity indicators also have a positive influence on creditworthiness;
- Contribution of the macroeconomic environment factors to corporate creditworthiness is statistically significant;
- There is no statistically significant long-term succession of the corporate credit rating.

Data

The sample is a well-balanced panel of 19 publicly traded non-financial companies that operate in the leading Russian industries: metallurgic, oil-and-gas extraction, chemical and power-generating sectors. See the list of companies in the Appendix (Table P1). Company eligibility criteria were as follows: 1) the presence of a Fitch rating as of the sample formation date; 2) affiliation with the abovementioned industries; 3) availability of financial and market indicators for the period in question; 4) similar value of gross assets of the companies under consideration; 5) use of IFRS[2] for the disclosure of financial and accounting information. IFRS guarantees high quality and comparability of data in the studied years. The observation period is from 2014 to 2018. There is a problem with data completeness and consistency for the country and corporate ratings. International rating agencies entered the Russian financial services market in 1996, but two years later their operations were suspended due to the "rouble crisis" and were resumed only in 2003. The number of rating companies grew in 2005 when for the first time Russia was assigned an investment-grade credit rating. Thus, a short history of credit rating assignment results in the lack of data even in the core Russian industries. Besides, it is impossible to resolve the data incompleteness problem for *Cor_Rtg* and *Sov_Rtg* variables by standard imputed data methods, therefore the sample and the time horizon were chosen in a manner that prevents omission of data on sovereign and corporate ratings. The 2014–2018 period is characterized by an unsettling market situation, however, apart from the effect of macroeconomic perturbations, credit ratings also account for the effectiveness of the subject's (countries' and companies') response. In the period in question a significant decrease (by two positions down to "BB-") of Russia's sovereign rating occurred in 2016 due to the exacerbation of the Ukrainian crisis, the sanctions imposed on Russia and counter-sanctions. However, it has no significant effect on corporate creditworthiness[3]. First of all, the decision of the international rating agencies was probably politically charged, and second, the risks of a drop in credit ratings of Russia and its companies have already been taken into consideration by market players in price quotes for Russian assets.

Sovereign and corporate credit ratings are the indicators designated by a letter according to a rating scale. In this paper we used the ratings assigned by the Fitch international agency, which covers the majority of Russian raw materials

[2] IFRS – International Financial Reporting Standards.

[3] This assumption was verified by the applied methodology of panel data modelling by comparing individual effects in time for 2016 and the rest period. The hypothesis of mathematical expectations equality for these effects was not rejected with error probability of 0.01.

companies. According to this agency's rating scale, credit ratings vary from "AAA" to "D". However, the studied sample is limited and does not have the full set of rating values. The absence of default ratings ("D") from the sample is not a rigid restriction because the "D" rating is largely defined by the factors other than the investment and upper sub-investment grades [40]. For the purpose of analysis, we introduced the encoding method in compliance with Basel II recommendations, which state that a high rating corresponds to a smaller numerical value (Table 1) [8; 35]. Therefore, the factors to which negative regression coefficients correspond in econometric models, apart from the corporate and sovereign rating variables, have a positive influence on the credit rating and vice versa.

Table 1. Rating scale encoding

Credit rating	Assigned value
BBB	0
BBB–	1
BB+	2
BB	3
BB–	4
B+	5

In order to account for currency risk, we used only long-term ratings in foreign currency (US dollars). The paper considers only the credit rating of the issuer (not a specific issue), which reveals the ability and readiness of the subject (country or company) to fulfill its financial obligations. The issuer's credit rating leaves out the nature and conditions of a specific debt instrument, its status in case of bankruptcy, warrants, insurance, and other properties of a particular obligation.

Table 2 presents the system of indicators used in the paper. The choice of explanatory microeconomic indicators is made on the basis of the experience of Fabozzi et al. [41] and Karminsky et al. [35–37; 42]. It indicates that corporate credit risk is characterized by such factors as its size, economic efficiency, debt load, liquidity, as well as cash flow amount and pattern, and the ability to service financial obligations. Databases of SPARK and Cbonds information agencies were used to create the system of idiosyncratic risk indicators. Macroeconomic indicators that measure the level of sovereign risk have been selected on the basis of research paper [20]. The data was obtained in publicly available databases of the IMF and the Central Bank of the Russian Federation. "+" and "-" in Table 2 designate the assumptions related to the expected influence of each factor, which were based on the results of the studies mentioned in the literature review.

Table 2. System of indicators used in the analysis

Group	Indicator	Designations	UOM	Expected effect of influence on the corporate rating
Country risk	Inflation	*INFL*	% per year	–
	Real GDP growth	*GDP_gr*	% per year	+
	Current transactions account	*CA*	% of GDP	–/+
	Gross public debt	*GGD*	% of GDP	–
	Per capita GDP	*GDP*	PPP, billion US dollars, natural logarithm	+
	Fiscal balance	*FB*	% of GDP	–
	Sovereign rating	*Sov_Rtg*	0 – the best value; 5 – the worst value	+
Corporate individual risk	Company size	*Size*	billion US dollars, natural logarithm	–/+
	Return on assets	*ROA*	% per year	+
	Financial leverage	*LEV*	% per year	–
	Equity capital / gross assets	*EA*	% per year	+

Group	Indicator	Designations	UOM	Expected effect of influence on the corporate rating
Corporate individual risk	Current liquidity	*QR*	% per year	+
	EBIT / interest payable	*DC*	% per year	+
	Undistributed profits (loss) / gross assets	*REA*	% per year	+
	Net working capital / gross assets	*WCA*	% per year	+

The Appendix (Table P2 and P3) contains an example of descriptive statistics for variables: for microeconomic variables – as at 2018, for macroeconomic variables – from 2014 to 2018. The variation coefficient of the *Size* variable demonstrates the homogeneity of companies in the amount of gross assets, however, their financial indicators vary greatly (see, for example, the *REA* variable) depending on the industry sector, their market share and financial and business operations' history. A significant difference between the minimal and maximum values of *INFL* is caused by the 2014 economic sanctions and the rouble crash, as well as by the transition to the inflation targeting regime, which resulted in a two-fold inflation decrease from 15.5% to 7% in 2016. A negative mean value of *FB* is indicative of the budget deficit in the studied period, which has been caused by a slump in oil-and-gas income in 2014, accompanied by increased expenses for the defense industry, support of the public administration office and social maintenance. Analysis of Pearson paired correlation coefficients between the considered factors indicates a significant correlation between certain macroeconomic factors, on the one hand, and, as a rule, an insignificant correlation between idiosyncratic risk indicators, on the other (see Appendix, Table P3). Atypical observations revealed as a result of construction of box plots for *QR* and *DC* were not eliminated.

Methodology

In order to study the influence of micro- and macroeconomic factors on the formation of the corporate rating with regard to the sovereign rating, we applied the econometric modeling methodology, which allows to measure ratings in the interval scale and use linear regression models (see, for example, [8; 20; 28]). The conclusions based on modeling results are premised on the assessment of the marginal effect of the sovereign rating value. We used the models evaluated on the basis of panel data as one-dimensional ones: the fixed effects model (FE model), the Hausman-Taylor model [43], the dynamic model, as well as a regression equations system. The Hausman-Taylor model and the simultaneous equations system have been applied in order to take into consideration the problem of endogeneity of the sovereign rating in the regression. The dynamic model allowed to define the level of historic succession of corporate risk. When assessing the models, we controlled the theoretically possible parameter estimator bias by verifying the convergence of interval estimate for the abovementioned models. We interpreted the results of the model that yielded the largest number of statistically significant estimates. In order to confirm the results of the analysis that utilized the abovementioned models, we also evaluated the ordered multiple-choice model, which is common in such rating analysis (see, for example, [40]). Note that in all considered models we used the same set of variables adjusted by eliminating regressors with statistically insignificant (0.05) assessments of coefficients in each specific model. Then we described the specification of those models indicating identification and quality assessment methods.

We considered the typical specifications of the FE model [44] (model 1):

$$y_{it} = \alpha_i + x_{it}\beta + \varepsilon_{it},$$

where α_t is the fixed individual effect of i company; $x_{it} = (x_{1,it},...,x_{k,it})$ – regressors' vector; β – regression coefficients' vector; ε_{it} – residuals.

$$E[\varepsilon_{it}\,|x_{l,js}] = 0,\ Cov[\varepsilon_{it},\varepsilon_{js}] = \begin{cases}\sigma_\varepsilon^2, & i=j,\quad t=s\\ 0, & \text{otherwise}\end{cases}$$

$$\varepsilon_{it} \sim N(0,\sigma_\varepsilon^2)$$

$$l = 1,2,...,k \quad i,j = 1,2,...,n \quad t,s = 1,2,...,T.$$

The model utilizes indicator designations introduced in Table 2:

$$x_1 = Size,\ x_2 = ROA,\ x_3 = DC \text{ и } x_4 = Sov\_Rtg,\ k = 4.$$

The model was evaluated by the least squares method (LSM) with adjustment of the covariance matrix of parameter estimators by the Beck-Katz method [45] and weighted LSM. The multicollinearity problem was resolved by a step-by-step addition of loosely correlated indicators in the regression equation. We tested the correctness of the model specification by applying the Wald test to compare with the pooled model and the Hausman test to compare with the random effects model (RE model). Model adequacy was verified on the basis of statistical significance of the model as a whole and by testing regression residuals for absence of heteroscedasticity (Breusch-Pagan test), 1st order autocorrelation (Durbin-Watson test, Wooldridge test), cross-sectional correlation (Pesaran test), and compliance with the normal law of distribution (Jarque-Bera).

The fixed effects model allows to detect a company's individual credit risk, however, its plausible evaluation is difficult because of the problem of sovereign rating endogeneity. which is apparent in the mutual influence of the sovereign and corporate ratings. On the one hand, public debt default causes national currency devaluation, which is accompanied by hyperinflation, contraction of the bank system and increased political distrust, social tension and reputational risks, which inevitably impair companies' financial stability. The sovereign obligation payment history directly determines the loan cost for the corporate sector. Each subsequent default of a serial non-payer incurs a loss of an increasingly smaller share of favorable credit reputation and increased debt servicing expenses. On the other hand, bankruptcy of systemic companies results in decreased industrial output, contraction of target markets, rise in unemployment and deterioration in demand and loss of budget revenues, thus undermining a country's creditworthiness and solvency.

The Hausman-Taylor model (model 2) was used in the paper according to the basic specification that accounted for individual time effects, which allow to monitor the instability of the dependent variable.

$$y_{it} = \xi_t + x_{1,it}\beta_1 + x_{2,it}\beta_2 + w_{1,t}\gamma_1 + w_{2,t}\gamma_2 + \varepsilon_{it},$$

where ξ_τ is the individual effect of t year; vectors $x_{1,t\tau} = (x_{11,it},...,x_{1k_1,it})$ and $x_{2,it} = (x_{21,it},...,x_{2k_2,it})$ comprise regressors that change subject to subject and vary with time;

vectors $w_{1,t} = (w_{11,t},...,w_{1q_1,t})$ and $w_{2,t} = (w_{21,t},...,w_{2q_2,t})$ comprise regressors invariant in relation to the subject in the observation period; $\beta_1, \beta_2, \gamma_1$ and γ_2 are vectors of regression coefficients; ε_{it} – residuals.

$Cov[\varepsilon_{it}, x_{1l_1,it}] = 0$, $Cov[\xi_t, x_{1l_1,it}] = 0$,

$Cov[\varepsilon_{it}, w_{1m_1,it}] = 0$, $Cov[\xi_t, w_{1m_1,it}] = 0$;

$Cov[\varepsilon_{it}, x_{2l_2,it}] \neq 0$, $Cov[\xi_t, x_{2l_2,it}] \neq 0$,

$Cov[\varepsilon_{it}, w_{2m_2,it}] \neq 0$, $Cov[\xi_t, w_{2m_2,it}] \neq 0$;

$$Cov[\varepsilon_{it}, \varepsilon_{js}] = \begin{cases} \sigma_\varepsilon^2, & i = j, \quad t = s \\ 0, & otherwise \end{cases}$$

$\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$

$i, j = 1,2,...,n \quad l_r = 1,2,...,k_r$

$m_r = 1,2,...,q_r \quad (r = 1,2) \quad t,s = 1,2,...,T$.

The model utilizes indicator designations introduced in Table 2:

$x_{11} = Size$, $x_{12} = ROA$, $x_{13} = EA$, $x_{14} = REA$,

$x_{15} = WCA$, $x_{16} = DC$, $k_1 = 6$;

$w_{11} = CA$, $w_{12} = GGD$, $w_{13} = Sov\_Rtg$,

$w_{14} = Sov\_Rtg_{t-1}$, $q_1 = 4$;

$w_{21} = Sov\_Rtg$, $q_2 = 1$.

As in paper [28], we presumed that the model has no endogenous regressors apart from *Sov_Rtg*.

The model was evaluated by means of the generalized method of moments (GMM), accompanied by the adjustment of the covariance matrix of parameter estimates using the Huber-White method [46; 47]. Model adequacy was verified on the basis of the statistical significance of the model as a whole and by means of testing regression residuals for compliance with the normal law of distribution.

The dynamic model is assessed by panel data and provides an opportunity to trace the dynamics of the dependent variable along with accounting for the individual effect α_i. Its specification is as follows (model 3):

$y_{it} = \xi_i + x_{it}\beta + \gamma y_{it-1} + \varepsilon_{it}$,

where $|\gamma| < 1$; ξ_i is the individual effect of i company; $x_{it} = (x_{1,it},...,x_{k,it})$ – vector of exogenous variables; $y_{i,t-1}$ – lag of endogenous variable; β and γ – regression coefficient vectors; ε_{it} – residuals.

$Cov[\varepsilon_{it}, \xi_i] = 0$, $Cov[\varepsilon_{it}, x_{l,js}] = 0$, $Cov[y_{i,t-1}, \xi_i] \neq 0$

$\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$

$i = 1,2,...,n \quad l = 1,2,...,k \quad t,s = 1,2,...,T$.

The model utilizes indicator designations introduced in Table 2:

$y_{1,t-1} = Cor\_Rtg_{t-1}$, $x_1 = Sov\_Rtg$, $x_2 = GGD$,

$x_3 = FB$, $k = 3$.

The model was evaluated by means of the generalized method of moments (GMM) applying the Arellano-Bond approach [49]. The $WCA_{i,t-2}$ variable was selected as an instrument along with dependent variable lags. Model adequacy was verified on the basis of the statistical significance of the model as a whole and by means of testing regression residuals for absence of autocorrelation and for compliance with the normal law of distribution. We applied the Sargan-Hansen test for over-identifying restrictions.

We also considered an over-identifying system of regression equations (model 4):

$$\begin{cases} y_{1,it} = y_{2,it}\gamma_1 + x_{1,it}\beta_1 + \varepsilon_{1,it}, \\ y_{2,it} = y_{1,it}\gamma_2 + x_{2,it}\beta_2 + \varepsilon_{2,it} \end{cases}$$

where $y_{1,it}$, $y_{2,it}$ are endogenous variables;

$x_{1,it} = (x_{11,it},...,x_{1k_1,it})$ and $x_{2,it} = (x_{21,it},...,x_{2k_2,it})$

– vectors of predetermined variables; γ_1, γ_2, β_1 и β_2 – regression coefficient vectors; $\varepsilon_{1,it}$ and $\varepsilon_{2,it}$ – residuals.

$$E[\varepsilon_{l_r,it} | x_{l_r,js}] = 0, \; Cov[\varepsilon_{r,it}, \varepsilon_{r,js}] = \begin{cases} \sigma_\varepsilon^2, & i = j, \quad t = s \\ 0, & \text{otherwise} \end{cases}$$

$$Cov[\varepsilon_{1,it}, \varepsilon_{2,js}] = \begin{cases} \sigma_{12}^2, & i = j, \quad t = s \\ 0, & \text{otherwise} \end{cases}$$

$i, j = 1,2,...,n \quad l_r = 1,2,...,k_r \quad (r = 1,2) \quad t,s = 1,2,...,T$.

The model utilizes indicator designations introduced in Table 2:

$y_1 = Cor\_Rtg$, $x_{11,t-1} = Sov\_Rtg_{t-1}$, $x_{12} = Size$,

$x_{13} = ROA$, $x_{14} = DC$, $x_{15,t-1} = DC_{t-1}$, $k = 5$;

$y_2 = Sov\_Rtg$, $x_{21} = GGD$, $x_{22} = GDP$, $x_{23} = CA$,

$k = 3$.

The model was evaluated by means of the GMM. Model adequacy was verified on the basis of the statistical significance of the model as a whole and by means of testing regression residuals for compliance with the normal law of distribution. We applied the Sargan-Hansen test for over-identifying restrictions.

The ordered multiple-choice model (model 5) was used as follows.

$$Prob\left[y_{it} = j\right] = Prob\left[c_{j-1} \le y_{it}^* \le c_j\right],$$

$$y_{it}^* = x_{it}\beta + \xi_i + \varepsilon_{it},$$

where j – current corporate rating; y^* – latent variable corresponding to y; c_j – evaluated fixed levels y^*; $x_{it} = (x_{1,it},...,x_{k,it})$ – regressors vector; ξ_i – a random effect of i company; β – regression coefficient vector; ε_{it} – residuals.

$\varepsilon_{it} \sim N(0,1)$, $E[\varepsilon_{it} | x_{l,js}] = 0$, $E[\varepsilon_{it} | \hat{\imath}_i] = 0$,

$E[\xi_i | x_{l,js}] = 0$

$l = 1,2,...,k \quad i = 1,2,...,n \quad t,s = 1,2,...,T \quad j = 1,...,m$.

The model utilizes indicator designations introduced in Table 2:

$y = Cor\_Rtg$, $x_1 = Size$, $x_2 = ROA$, $x_3 = EA$,

$x_4 = REA$, $x_5 = DC$, $x_6 = CA$, $x_7 = FB$, x_8, x_9 –

dummy variables accounting for the sovereign rating[4].

The model was evaluated by the maximum likelihood method accompanied by adjustment of the estimated covariance matrix of parameter estimates by the Huber-White method.

Note that the advantage of models 1-4 over model 5 is their more descriptive and informative interpretation of parameter estimates, because the latter only allows to interpret their signs.

Results

The results of analysis of the evaluated models' quality confirmed that the models were specified and identified in a rather adequate manner, guaranteeing the consistency of parameter estimates and possibility of their interpretation. We will describe some of the analysis results. Testing of the FE model residuals showed a statistically significant (α = 0.05) absence of cross-sectional correlation: the p-value of χ^2-statistics of the Pesaran test amounted to 0.33. The model was selected reasonably after a comparison to the pooled model and the random effects model: the p-value of corresponding χ^2-statistics of the Wald test and Hausman test amounted to 0.001 and 0.005. We used sufficiently valid tools for a GMM assessment of the dynamic model and the simultaneous equations system: p-value of χ^2-statistics of the Sargan-Hansen tests amounted to 0.75 and 0.998 respectively. The dynamic model produced a positive result of the Arellano-Bond test for the absence of autocorrelation of residuals: p-values of its two successive χ^2-statistics equaled 0.046 and 0.82. The fact that all evaluated models are statistically significant when α = 0.05 is common and positive for all models. The fact that the hypothesis of compliance of regression residuals with the normal distribution is rejected at the significance level of α = 0.05 is common and negative for all models. The p-values of χ^2-statistics of Jarque-Bera tests (for one-dimensional models) and Doornik-Hansen tests (for the regression equations system) did not exceed 0.005.

There is a certain stability of estimates for models 1–4 in the transition from one model to another. The results of evaluation of model 5 do not contradict the results of models 1–4 in regard to the signs of coefficients' estimates. Below is a consolidated table of the evaluation results for models 1–5 (Table 3). The Appendix (see Table P4) provides more detailed assessment results for model 4. Table 3 shows a certain ambiguousness of model parameter estimate assessment, which is indicative of estimator bias due to, in particular, the endogeneity problem of certain regressors, including the sovereign rating. However, the intersection of 95% confidence intervals of these estimates allows to consider these results acceptable. Models 2 and 4 assessed with regard to endogeneity of the sovereign rating are more effective in comparison to models 1 and 3, which do not take endogeneity into account. Model 2 has more statistically significant estimates of parameters as compared to models 1, 3, 4, and is more informative than model 5. Therefore, the informative interpretation of analysis results is stated further, mainly based on model 2 estimates. Let us also note that the option of tracing corporate rating instability over time is an advantage of this model. So, it was demonstrated that the "2016 effect" (ξ_{2016}), which corresponds to a significant decrease of the sovereign rating (by two positions, up to BB-) that year did not manifest itself in a statistically significant way (0.05) in the formation of the corporate rating.

The suggested hypotheses about the vector of influence of the indicators in question on the credit rating level in Russia were partially confirmed. The hypothesis of a positive correlational relationship between the sovereign and corporate ratings is not rejected at the 5% level for all models. A direct dependence between the sovereign and corporate ratings is observed: a decrease of the

[4] The number of slack variables was determined on the basis of ranking of the sovereign rating in the sample, namely, its values of 1, 2, 4 were taken into consideration.

country credit rating by one position results in an almost equal decrease of corporate creditworthiness, which is economically significant if the transition is made from a "junk" grade to an investment grade and vice versa. The economic significance of this change is due to the fact that, first, a company's credit rating influences its access to the capital market including, among other things, the bond market, by determining whether institutional investors (banks, pension funds) are allowed to invest in this company's securities. Second, credit ratings influence capital requirements for banks and insurance companies when they decide to invest in certain companies. Third, a decrease in the corporate rating may cause violations of covenants, growth of interest rates on loans and coupon payments, result in bond buy-out and influence relations with customers and business operations, including a company's ability to conclude and maintain long-term contracts.

Table 3. Consolidated results of assessment of models

Variable	Designations	Coefficient				
		Model 1	Model 2	Model 3	Model 4	Model 5
Company size	*Size*	**1.275***** (0.256)	**–0.412***** (0.060)	–	**0.053*** (0.030)	**–0.856***** (0.269)
Return on assets	*ROA*	**0.008***** (0.003)	**0.004***** (0.001)	–	**0.037** (0.027)	**0.004** (0.004)
Equity capital / gross assets	*EA*	–	**–0.008***** (0.002)	–	–	**–0.162***** (0.005)
Retained profits (loss) / gross assets	*REA*	–	**0.004**** (0.002)	–	–	**0.020*** (0.012)
Net working capital / gross assets	*WCA*	–	**0.010***** (0.004)	–	–	–
EBIT / interest payable	*DC*	**–0.001***** (0.0002)	**–0.0005***** (0.0001)	–	**–0.003** (0.002)	**–0.0006*** (0.00003)
Corporate rating	*Cor_Rtg*	–	–	–	**0.067**** (0.034)	–
Corporate rating (1st lag)	–	–	–	**0.485***** (0.125)	–	–
Current account	*CA*	–	**0.635***** (0.056)	–	**–0.319***** (0.005)	**0.083** (0.057)
Gross public debt	*GGD*	–	**0.490***** (0.065)	**1.049*** (0.561)	**0.552***** (0.017)	–
GDP per capita	*GDP*	–	–	–	**–0.210***** (0.010)	–
Sovereign rating	*Sov_Rtg*	**0.118***** (0.016)	**0.821***** (0.061)	**0.253**** (0.104)	**0.691**** (0.409)	–
Sovereign rating (1st lag)	–	–	**0.824***** (0.074)	–	**0.525** (0.340)	–
Fiscal balance	*FB*	–	–	**0.345*** (0.179)	–	**0.216** (0.143)
Dummy variable for *Sov _ Rtg* = 2	–	–	–	–	–	**1.156*** (0.595)
Dummy variable for *Sov _ Rtg* = 4	–	–	–	–	–	**1.939**** (0.806)

Note: 1) the table presents regression coefficient estimates; 2) "–" means that a regressor not used in the model; 3) p-value: *10%, **5%, ***1%; 4) robust standard errors are within the brackets.

Similar to previous papers (see, for example, [8; 14; 18; 38; 49]) we found out that company size has a positive effect on its credit risk level: its increase by one unit results in an improvement of its credit rating by one position, which is an economically significant result. The positive effect of the *Size* indicator on the corporate rating level is due to the fact that large companies with more opportunities to maneuver resources are characterized by a higher external (ability to service debt obligations) and internal (assets secured by financing sources) financial stability (including under unfavourable market conditions). Besides, their scale may lead to cost reduction due to function centralization or replication of technology. Function centralization implies elimination of certain functions at the local level and their integration in a unified center, which results in uniformity and synergy of the corporate system, elimination of duplicate functions and reduction in operating expenditures. Note that in practice centralization procedures may be cost-ineffective if all project implementation expenses are calculated. Technology replication consists in formalizing the company's technology (for example, sales, accounting or corporate training technology) with its subsequent replication for all corporate subdivisions. Success of replication projects depends on the quality of technology. Nevertheless, the assertion that mass implementation of standard technology has a positive effect on the quality of the finished product is controversial. Advantages of reducing marginal fixed costs and decreasing long-term average costs while the company grows seem obvious, however, a range of restrictions related to the sluggishness of cumbersome systems and increase in transaction costs should be taken into consideration. However, further company expansion may in fact bring about a deterioration in financial and business operations' performance, and consequently, a decrease in its credit rating. The reasons for diminishing returns as a function of size in large companies are as follows [50]: 1) loss of the necessary control over implementation of management decisions; 2) increased costs for the transfer, processing and storage of information; 3) reduced effectiveness of interaction between subdivisions; 4) local interests. Thus, the structure of small and medium companies is more flexible and adaptable to the changing market situation, which ensures their competitiveness.

According to the analysis results, the *CA* indicator, with net export as the main component, has a negative influence on the corporate credit rating. As a rule, an increase in raw materials export contributes to the growth of exporting companies' income, and an improvement of their creditworthiness and solvency. However, export that exceeds the optimum level causes market flooding, a drop in prices of natural resources, and consequently, impaired company ratings due to the deterioration of financial soundness. The current account is affected by the amount of exported natural resources as well as by their global prices. The rise in global prices of raw materials leads to the growth of exporting companies' income, and hence, tax receipts, including the state budget, which has a positive influence on corporate and sovereign creditworthiness. It should be noted that, as a rule, growing income does not instantly result in an increase of the internal expenses of exporting companies, or the government (partly because their amount is defined by a budget adopted beforehand). From the macroeconomic point of view, an increase in expenses immediately following a rise in prices is even undesirable because it may upset the balance between the aggregate demand and supply, and trigger a rise in the inflation rate. An increase in prices of natural resources also has a positive impact on the creditworthiness of exporting companies due to the growth of the nominal exchange rate, which increases the balance of the current account and improves the total trade balance. However, the rise in prices of energy resources triggers a rise in the overall price level in a country, thus increasing manufacturing costs, slowing down economic growth rate and decreasing the aggregate income, and consequently, bringing about a deterioration of the corporate sector's financial stability.

In contrast to the results of previous studies [8; 28] we detected a negative influence of *ROA*, whose growth by 100 basis points (b.p.)[5] results in a decrease of the corporate credit rating by 0.4 b.p. on average. Note that such a small contribution of each financial coefficient to the corporate credit rating is acceptable because agencies use numerous indicators of financial and business operations when assigning ratings. The obtained result is related to the special structural characteristics of the Russian raw materials market. The market of extraction and processing of energy and other natural resources is oligopolistic. The Russian raw materials market is an example of a special form of oligopoly – "fair play," which implies a compromise between an uncoordinated oligopoly and a direct collusion. Companies may not have formal agreements with each other, but act according to certain informal rules. On the one hand, this policy helps to avoid legal liability arising out of the anticartel legislation; on the other – to mitigate the risk of competitors' unpredictable response. The most frequent maneuver in "fair play" is price leadership. In fact, the price leader single-handedly defines the prices (hence, the production volume) for resources that are copied by other companies with slight modifications. The price level is determined in a way that is economically advantageous to all participants of the oligopolistic structure. Therefore, the leader often "probes" the competitors' disposition when making public declarations on the extent of upcoming changes and examines the response of other companies. Moreover, the sanctions imposed in 2014 brought back the government support for raw materials and primary processing product markets, thus strengthening each company's strictly defined concentration [51]. Disruption of balance in one company's oligopolistic structure leads to a deterioration of the general financial stability.

Expectations of a positive influence of *REA* and *WCA* on the credit rating in the private sector were not confirmed.

[5] Basis point is understood as one hundredth of percent.

Ambiguity of interpretation of REA's influence, which characterizes the share of assets financed from retained profits is related to the dependence of its optimum value on the stage of the corporate life cycle. As a rule, *REA* is greater for young companies, which are attractive for investors due to a quick rise in the price of their equity instruments. At the mature stage, company growth slows down; the need for accumulated profit is reduced and, therefore, it is more prone to the distribution of the obtained profit among investors in the form of dividends [52]. An excessive growth of *REA* due to the most flexible part of the indicator – the retained profit – is indicative of the unwillingness of a mature company to "share profits". Investors' interest decreases, resulting in their withdrawal from the corporate sector's capital, consequently, the company's credit quality degrades. The studied sample comprises companies with a long history of financial and business operations. This explains the obtained result.

The controversial nature of *WCA's* influence is related to the "cost-effectiveness – liquidity" problem, which implies the company's striving to combine dynamic development and high solvency [53]. Paper [54], which used the data from Russian capital-intensive telecommunication, power-generating and iron and steel companies revealed an inverse correlation between liquidity and cost-effectiveness indicators. The conclusion that *WCA* growth as a liquidity indicator may damage corporate credit rating is due to the need to prolong the financial cycle[6] (to maintain the optimum liquidity level), on the one hand, and to shorten it (to improve cost-effectiveness), on the other hand [55–57]. A *WCA* increase of 100 b.p. decreases the corporate credit rating by 1 b.p. on average, which is two times larger than the effect of growth of *ROA* and *REA,* whose contribution to the formation of the corporate credit rating is virtually the same.

A positive influence of *EA* and *DC* [8], which characterize the level of a company's financial independence and its ability to generate positive cash flows sufficient to cover short-term financial obligations was expected. The result may be explained by the fact that the financial effect of use of borrowed funds manifests in an increased return on assets of the private sector because it reduces its default risk. However, in fact, this conclusion is not always correct. When financial leverage increases significantly, a substantial slowdown of its positive effect takes place, i.e. from a certain moment on there is no point in increasing borrowed capital and its servicing [58]. Note that a positive contribution of the *DC* factor to the corporate creditworthiness level is not economically significant and amounts to 0.05 b.p. This result may mean that a company's ability to service long-term financial obligations is more important in the formation of its credit rating than its ability to service short-term obligations. The ability to pay off long-term debts depends not just on a company's financial and business performance, but also on macroeconomic factors, which significantly raise the level of uncertainty related to timely and full payments of the debt.

One of the main factors that define the systemic risk is the total national debt load, which, when increased, undermines companies' financial stability, hence impairing their credit estimates. A negative effect may be observed due to capital outflow from the country and reduction in foreign direct investment caused by the growing budget deficit or increased taxation required for the timely servicing of national financial obligations. The negative influence of FB on corporate creditworthiness indicates that a significant part of the national budget's income base is made up of taxes paid by legal entities.

The contribution of macroeconomic environment factors to the corporate creditworthiness level is more significant in comparison to the contribution of idiosyncratic risk indicators. Apart from GDP per capita, a 100-b.p. change in each country risk indicator results in the change of the corporate credit rating by an economically significant value: on average by approximately 60–80 b.p.

According to analysis results, corporate credit rating has a "short memory" because estimates of lag coefficients *Cor_Rtg* turned out to be statistically insignificant ($\alpha = 0.05$) starting from the second order inclusively. Consequently, only the previous year's rating influences the current credit rating value. This result confirms the practice of assigning corporate credit ratings, according to which the current year's corporate credit rating is formed with regard to the corporate and sovereign ratings of the previous and current year respectively [12; 13].

Conclusion

Based on the data of Russian companies we have studied the determinants of their credit risk with regard to the sovereign rating. A statistically significant direct influence of the sovereign rating on the corporate rating was demonstrated. A positive effect of financial independence and company size indicators on the corporate creditworthiness level was revealed. In contrast to similar foreign and Russian studies, a negative influence of certain cost-effectiveness and liquidity indicators and export-import government activity indicators was determined. This result is primarily related to the specifics of the Russian raw material market structure and to the special features of financial and business operations in the national and global markets of extraction and processing of raw materials and other natural resources. We confirmed that the corporate credit risk level was determined by a company's fundamental financial indicators, as well as by the macroeconomic environment in which it operates. It was also discovered that the "short memory" feature is characteristic of the corporate credit rating because its current level is defined only by the previous year's value. The results of the present research are partially in line with the results of papers [8; 28; 20; 36–38].

[6] FC = ITP + ARP – APP, where FC – financial cycle; ITP – inventory turnover period; ARP – accounts receivable turnover period; APP – accounts payable turnover period.

They are independently valuable because they demonstrate the specific character of credit rating formation for Russian companies from a certain sector, specifically – the raw materials sector.

Research papers dedicated to the influence of the sovereign rating on corporate credit rating are of great importance for the improvement of Russian companies' investment attractiveness. Further research of this topic requires a study of both quantitative and qualitative factors that determine corporate and sovereign credit risks. The sample needs to be expanded in order to obtain more accurate results and to extend the range of examined sectors that may respond to the changes in the country credit rating in different ways. Moreover, the direct influence of the fluctuations of the sovereign credit rating on the corporate financial and investment policy also requires further research.

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Appendix

Table P1. List of companies in the sample

Industry	Corporate issuer
Metallurgy	Metalloinvest HC
	Chelyabinsk Pipe-Rolling Plant
	RUSAL Bratsk
	Mining and Metallurgical Company Norilsky Nickel
Oil and gas	Rosneft Oil Company
	Transneft
	Gazprom Neft
	Bashneft
	Gazprom
Chemical industry	Uralkali
	SIBUR Holding
	Mineral and Chemical Company Eurochem
	Akron
Power generating industry	FGC UES
	RusHydro
	Moscow United Electric Grid Company
	AtomEnergoProm
	Interregional Distribution Grid Company Centre
	LenEnergo

Table P2. Result of preliminary analysis of primary data

Group	Indicator	UOM	Mean	Minimum	Maximum	Coefficient of variation, %	Asymmetry	Excess kurtosis
Country risk	Inflation	% per year	7.38	2.90	15.50	60,8	0.89	–0.53
	Real GDP growth	% per year	0.52	–2.3	2.3	303.8	–0.79	–0.56
	Current account	% of GDP	3.72	1.90	6.80	51.1	0.60	–1.27
	Gross public debt	% of GDP	15.74	14.60	16.40	4.07	–0.84	–0.73
	Per capita GDP	PPP, billion US dollars, natural logarithm	25.19	25.17	25.22	0.06	0.35	–1.13
	Fiscal balance	% of GDP	–0.90	–3.20	–0.14	244.4	0.60	–0.92
	Sovereign rating	0 – the best value; 5 – the worst value	2.00	4.00	1.00	55	0.91	–0.50
Individual corporate risk	Company size	billion US dollars, natural logarithm	27.16	24.7	30.39	5.5	0.48	–0.16
	Return on assets	% per year	8.74	–1.00	49.00	133.3	2.48	5.87
	Financial leverage	% per year	13.79	–59.00	75.00	313	–0.13	–1.21
	Equity capital / gross assets	% per year	96.95	25.00	245.00	56.7	0.86	0.78
	Current liquidity	% per year	178.23	23.00	763.00	108	1.83	2.69
	EBIT / interest payable	% per year	479.13	–52.00	1680.00	114.6	0.73	–0.72
	Retained profits (loss) / gross assets	% per year	25.79	7.00	70.00	66.15	1.25	0.73
	Net working capital / gross assets	% per year	25.84	4.00	65.00	62	0.71	–0.15
	Corporate rating	0 – the best value; 5 – the worst value	2.21	5.00	0.00	57.7	0.42	–1.45

Table P3. Pearson paired correlation coefficients

	Size	ROA	LEV	EA	QR	REA	WCA	DC	INFL	GDP_gr	CA	GGD	GDP	FB
Size	1													
ROA	-0.18	1												
LEV	-0.15	0.04	1											
EA	0.24	-0.06	-0.61	1										
QR	0.18	-0.07	-0.41	0.26	1									
REA	-0.02	0.08	-0.41	0.28	0.16	1								
WCA	-0.12	-0.03	0.41	-0.15	0.12	0.04	1							
DC	-0.07	-0.01	-0.17	-0.02	0.31	0.12	-0.15	1						
INFL	-0.04	-0.09	0.06	-0.02	-0.04	-0.08	0.07	-0.04	1					
GDP _gr	0.03	0.07	-0.06	0.02	0.01	0.08	-0.05	0.04	-0.98	1				
CA	0.03	-0.11	-0.02	0.05	0.06	0.01	-0.01	0.01	0.07	0.02	1			
GGD	-0.05	-0.01	0.07	-0.05	-0.03	-0.08	0.07	-0.04	0.79	-0.83	-0.42	1		
GDP	0.03	-0.02	-0.05	0.03	0.05	0.06	-0.02	0.03	-0.75	0.84	0.41	-0.39	1	
FB	0.03	-0.06	-0.05	0.04	0.04	0.06	-0.02	0.02	-0.66	0.76	0.59	-0.43	0.97	1

Table P4. Results of evaluation of the simultaneous equations system

Equation	Variables		Coefficients
(1)	Endogenous	Corporate rating	
	Predetermined	Company size	0.053* (0.030)
		Return on assets	0.037 (0.027)
		EBIT / interest payable	-0.003 (0.002)
		Sovereign rating	0.691* (0.409)
		Sovereign rating (1st lag)	0.525 (0.340)
		EBIT / interest payable (1st lag)	0.005 (0.003)
(2)	Endogenous	Sovereign rating	
	Predetermined	Gross public debt	0.552*** (0.017)
		Per capita GDP	-0.210*** (0.010)
		Current account	-0.319*** (0.005)
		Corporate rating	0.067** (0.034)
Test			P-value
Wald test			<0.0001
Sargan test			0.998
Doornik-Hansen test			<0.0001

Note: (1) the table presents assessments of the regression coefficient; (2) p-value: *10%, **5%, ***1%; (3) robust standard errors are within the brackets.

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