Econometric Modeling of Integration Activity in the Russian Economy

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Abstract. A dynamic process of forming complex structured economic entities at the sectoral, interindustry, and interregional levels based on the integration policy takes place in the modern economy. A structural change happens in mergers and acquisitions transactions; they involve an increasing number of participants; the scale of cross-border transactions is expanding, the state becomes an active participant. At the same time, the nature and complexity of integration processes require qualitative tools for a comprehensive analysis of the integration activity of Russian companies. The aim of the research presented was the development of an econometric approach to the analysis of integration policy in the Russian economy. Multidimensional statistical and econometric methods for analysing the dependencies, reducing the dimension and classification, as well as the system of econometric equations were used as a research tool. The econometric approach is based on a recursive system of simultaneous equations describing the integration activity of Russian companies and the impact of various macroeconomic indicators on it. The analysis of the model obtained proves a unidirectional change in the volume of foreign investments and the value of mergers and acquisitions transactions, as well as the inverse relationship between the volatility of the stock market and the value of integration transactions. The results of the research are of practical importance, since they can be used in order to identify favorable conditions for doing business, improve the investment climate, as well as to increase the validity of decision-making on the socioeconomic development of Russian territories.

Keywords: integration activity, simultaneous equations systems, econometric approach

1 Introduction

The role of integration policy in the system of economic relations of any state has significantly increased in recent decades. The scale and level of economic in-

tegration are largely macroeconomic indicators of the effective functioning of the national economy and its institutions. Integration processes under modern Russian conditions restore the structural integrity of the national economy, equalise the spatial characteristics of the country's industrial potential, activate the innovative business activity, and increase the competitiveness of domestic products that is the key to the reindustrialisation of the domestic economy.

The processes of integration policy are the objects of close attention and numerous studies. However, the issues of economic content and quantitative measurement of the integration activity in the Russian economy remain insufficiently developed. Moreover, it is impossible to reindustrialise the Russian economy successfully, as well as to create an effective economic system with a fundamentally new nature of corporate relationships without statistical consideration of the factors that determine the integration activity of Russian companies. In this regard, there is a need to model the processes of mergers and acquisitions of Russian companies based on modern econometric approaches.

2 Econometric analysis of mergers and acquisitions processes in the Russian economy

Integration processes in business aimed at its scale and market share increasing become an important factor in raising competitiveness under the conditions of Russia's imposing economic sanctions and increasing international isolation. The research of the mergers and acquisitions (M&A) processes and the integration activity in various states with an advanced institutional environment is largely based on econometric methods and models [7, 10, 16].

Thus, Choi S. H. and Jeon B. N. studied the dynamic impact of macroeconomic factors on the integration activity in the USA economy for the period 1980–2004 in their work [8]. Firstly, the long-term equilibrium relationship between the frequency volume of the integration activity and the main macroeconomic variables including real GDP, monetary aggregates, interest rates, and stock indices were analysed in the framework of this approach. Secondly, the short-term dynamics between M&A activity and macroeconomic variables was investigated based on the vector autoregressive model (VAR).

In the 1990's, the importance of the macroeconomic environment influence on the location of international production in the host country (M&A export transactions) against the intensification of globalisation processes was widely discussed in foreign scientific literature. Thus, Hughes H., Uddin M., and Nottingham M. in the article [5] investigated the economic impact of shocks for the specific country economy on mergers and acquisitions transactions over the period 1987–2008 on the example of Great Britain, which was the leader among European countries in the international market for corporate control. The vector autoregressive model and the error correction model (VAR/VECM) served as a tool for the study. The author drew a conclusion that the number of external mergers and acquisitions transactions has a significant connection with the

country's GDP, with the money supply and an effective exchange rate in the long-term outlook.

A relatively short time series of domestic databases on M&A transactions, which can give a very diffuse assessment of the Russian market of external mergers and acquisitions, is one of the serious limitations for the use of this kind of model in Russia. Insufficient development of tools of the Russian stock market for transaction payment may be another restriction apart from the sample size [2]. Unfortunately, despite the increased degree of information openness in Russia, many Russian M&A transactions happen under non-transparent conditions; business owners often prefer the confidentiality of the information about the amount of transactions.

Bhattacharjee A. and Higson S. in their work [3] investigated the influence of the macroeconomic environment on the probable business exit of enterprises in a model where mergers and bankruptcies are jointly defined and are mutually exclusive processes.

Thus, a large number of foreign authors devoted their works to the dynamics of macroeconomic indicators and its impact on the intensity of mergers and acquisitions processes. At the same time, this research direction is relevant also for the Russian economy. Although many models of this direction have not yet been realised under Russian conditions, nevertheless it has recently become possible to analyse the relationship between Russian corporate integration processes and a number of macro variables [13].

Ignatishin Yu. V. was the first who used econometric methods for the study of the market for corporate control [9]. He calculated correlation and regression relationships between the data on mergers and acquisitions and a number of macroeconomic variables such as inflation indicators, oil prices, the exchange rate for Ruble to Euro and to US dollar, the RTS index, etc.

Musatova M. M. proposed a regression model of relationship between macro variables and the dynamics of M&A transactions over 2001–2004 [15]. The author modelled a number of integration transactions using Poisson regression with added seasonal components. The growth rate of real industrial production, the balanced financial result of the main branches of the economy, the statistical volatility of the RTS index and the proportion of loss-making organisations in the total number of industrial organisations were taken as exogenous variables in the work.

At the same time, an assessment of the close relationship between individual variables and the creation of regression equations is not enough in order to describe the mechanism of the functioning of the market for mergers and acquisitions. To characterise the true impact of individual characteristics on the change in the system of the resulting indicators of the M&A market it is not reasonable to consider the multiple regression equation taken separately. In this case, these processes can be described with systems of interrelated (simultaneous) equations.

For a complex analysis of the market of mergers and acquisitions it seems necessary to use 3 resulting variables with a causal and consecutive relationship based on information collected monthly from January 2003 to December 2015

(156 observations): y_1 — the cost of conflict assets; y_2 — the number of integration transactions; y_3 — the cost of integration transactions.

Various factors that determine the specificity and efficiency of the use of integration strategies for growth and development by business entities influence the integration processes. The internal prerequisites for mergers and acquisitions may include: the achievement of certain financial indicators that are necessary for the further development of the company and its transition to a qualitatively new level; the correction of a company's financial position, when integration with other market participants will allow to solve a number of unsolvable problems.

The ongoing macroeconomic processes can be attributed to the external factor that influences the development of mergers and acquisitions processes. The impact of the stock market and its capitalisation on the M&A market is that one of the main integration schemes is based on the acquisition of shares of the target company [14]. In this regard, most researchers agree that the correlation between the indicators of the market volume for the integration transactions and the development of the stock market is clearly pronounced.

According to the experts of the committee on corporate finance and financial management of the audit and consulting firm FAC, investments are one of the indicators of the mergers and acquisitions market movement. Currently, Russia lags behind most post-Soviet countries in terms of the level of investment for infrastructure development that is reflected in the fact that the share of foreign buyers in the total value of mergers and acquisitions transactions has been recently decreasing.

According to the research of the CMS consulting company and the Mergermarket analytical agency, which was based on the survey of top managers among 32 large companies and 100 participants of the Russian market of mergers and acquisitions in 2015, the institutional reforms in the economy and, particularly, the state privatisation program have impact on the market of mergers and acquisitions in the Russian Federation. The government intends to sell minority block of shares in the leading state-owned enterprises in order to reduce the budget deficit, increase the investment attractiveness of assets, and attract serious private investors in privatised companies.

According to the press service of the government, in February 2017, the head of the government approved the forecast privatisation plan for 2017–2019. The budget with revenues from privatisation without taking into account the sale of shares in the largest companies should reach 5.6 billion rubles annually. It is planned to privatise 477 JSCs, 298 FSUEs, the Russian Federation's stake in 10 PLCs, as well as 1041 property of the state treasury for the period 2017–2019 in total. In particular, it is envisaged that Russia will cease to participate in Novorossiysk Commercial Sea Port PJSC, United Grain Company, Prioksky Non-Ferrous Metals Plant, and Crystal PA.

When characterising the Russian market, a special attention should be paid to crimes and offenses in the sphere of economic activity. Clever abuse of procedural rights during corporate conflicts entails the difficulty and frequently the complete paralysed activities of economic entities of the Russian market that

causes significant material losses [17]. According to the experts of the department for especially dangerous crimes in the sphere of economic activity of the Investigative Committee attached to the Ministry of Internal Affairs of Russia, raiding is because the cost of capturing assets in most cases is significantly lower than the price of their loyal acquisition.

Thus, the factors that directly influence the intensity of mergers and acquisitions processes (see Fig. 1) for the period from January 2003 to December 2015 were divided into 6 functional blocks: macroeconomic indicators (11 variables); corporate finance (12 variables); the Russian stock market (12 variables); investments (8 variables); institutional changes in the economy (7 variables); crimes and offenses in the economic sphere (4 variables). At the same time, it should be noted that in reality the causal relationship between the integration activities and selected regressors is multiple-valued [6]: the integration transactions can affect both the volume of industrial production and the financial results of companies and sectors of the economy.

1. Macroeconomic indicators	2. Corporate finance	3. Russian Stock Market
x_1 – GDP volume, bn rubles; x_2 – the consumer price index, %; x_3 – the producer price index for manufactured products, %; x_4 – the index of industrial production, %; x_5 – the producer price index for manufactured products by December of the previous year, %; x_6 – deficit/surplus of the consolidated federal budget of the Russian Federation, bn roubles; x_7 – external turnover, bn dollars; x_8 – export surplus, bn dollars; x_9 – the volume of international reserves, bn dollars; x_{10} – money stock M_2, bn rubles; x_{11} – the unemployment rate, %.	x_{12} – the number of large and medium-sized enterprises and entities, units; x_{13} – the financial result of profitable large and medium-sized enterprises and entities, units; x_{14} – the financial result of unprofitable large and medium-sized enterprises and entities, units; x_{15} – profit (loss) of large and medium-sized enterprises and entities for the reporting period, bn rubles; x_{16} – the specific weight of unprofitable entities in the total number of entities in industry, %; x_{17} – creditor indebtedness among large and medium-sized enterprises and entities, bn rubles; x_{18} – overdue creditor indebtedness among large and medium-sized enterprises and entities, bn dollars; x_{19} – indebtedness for loans and borrowings among large and medium-sized enterprises and entities, bn dollars; x_{20} – overdue indebtedness for loans and borrowings among large and medium-sized enterprises and entities, bn dollars; x_{21} – the number of large and medium-sized enterprises and entities that have overdue creditor indebtedness, units; x_{22} – an overdue creditor indebtedness among large and medium-sized enterprises and entities, bn rubles; x_{23} – the number of large and medium-sized enterprises and entities that have overdue indebtedness, units.	x_{24} – stock market volatility-1 (RTS index); x_{25} – stock market volatility-2 (MICEX index); x_{26} – general capitalisation of the Russian stock market, bn rubles (calculated according to the method of Stocks.Investfund.ru); x_{27} – the stock market turnover in Russia, bn rubles; x_{28} – RTS Oil & Gas Index; x_{29} – MICEX Finance index; x_{30} – official exchange rate of the Ruble to the US dollar at the end of the period, rubles for 1 dollar. x_{31} – the price of the URALS-grade oil (dollars per barrel); x_{32} – the price of gold (rubles per gramm, Bank of Russia); x_{33} – the indicative rate of providing ruble loans (deposits) in the Moscow money market, %; x_{34} – the number of shares traded in the Russian stock market, units; x_{35} – the number of traded issuers in the Russian stock market, units.
4. Investments		
x_{36} – the volume of fixed capital investments, bn rubles; x_{37} – received foreign investments – a total (in $), taking into account the conversion terms of the ruble equivalent, bn dollars; x_{38} – overseas direct investments made by Russian enterprises – a total taking into account the conversion terms of the ruble equivalent, bn dollars; x_{39} – long-term financial investments made by entities, bn rubles; x_{40} – long-term financial investments made by entities at their own expense, bn rubles; x_{41} – short-term financial investments made by entities, bn rubles; x_{42} – short-term financial investments made by entities at their own expense, bn rubles; x_{43} – expenses for research, development and technological works, bn rubles		**5. Institutional reforms in the economy** x_{44} – the number of privatised property complexes of the state and municipal unitary enterprises, units; x_{45} – the number of OJSCs created as a result of the transformation of state and municipal unitary enterprises, units; x_{46} – the book value of assets subjected to privatisation (the size of the authorised capital of an OJSC) of state and municipal unitary enterprises, bn rubles; x_{47} – the price of the privatisation transaction (market value) of the property complex of state and municipal unitary enterprises, bn rubles; x_{48} – the funds received from the buyers of state and municipal property, bn rubles; x_{49} – The size of the authorised capital of an OJSC established as a result of the transformation of state and municipal unitary enterprises, bn rubles; x_{50} – the number of issued shares of OJSC, thousand shares.
	6. Crimes and offenses in the sphere of the economy	
	x_{51} – the number of crimes committed in the sphere of economy, units; x_{52} – the number of cases of administrative infraction, units; x_{53} – the amount of fines imposed, bn rubles; x_{54} – the cost of conflict assets, bn dollars; x_{55} – the number of criminal cases related to unlawful acts in encroachment on the economic foundations of the state (raiding).	
Source: author's developments		

Fig. 1. Factors affecting the intensity of mergers and acquisitions processes

One should pay attention to the fact that there is a causal relationship in the effective variables. The key characteristic of the M&A market is the M&A market value which directly depends on the number of transactions. At the same time, due to the specifics of the Russian market for corporate control, the cost of conflict assets has a direct impact on the market value and the number of integration transactions.

Further, the Granger causality test was used to test these assumptions for causal dependency; this test includes the application of the Fisher test which is used to check whether the lag information about the variable x has a statistically significant effect in explaining y_t at accounting explanatory variables and lagged values of y [12]:

$$y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i y_{t-i} + \sum_{i=1}^{m} \beta_i x_{t-i} + \varepsilon_i. \tag{1}$$

If lagged x in the presence of lagged y does not make a statistically significant contribution to the explanation of y_t, then it is considered that "x does not Granger cause y". Alike, if lagged y does not contribute a statistically significant input in explaining x_t in the presence of lagged x:

$$x_t = \mu_0 + \sum_{j=1}^{k} \mu_j x_{t-j} + \sum_{j=1}^{k} \eta_j y_{t-j} + \varepsilon_j, \tag{2}$$

then it is considered that "y does not Granger cause x".

The hypotheses presented in Table 1 were put forward to clarify the causal relationship between the resulting factors.

As a result of the analysis, it was found that the value of conflict assets is a Granger cause for the number of mergers and acquisitions transactions and the monetary value of the M&A market, but the number of integration transactions is a Granger cause for the monetary value of the M&A market. All abovementioned shows that the model of the integration activity in the Russian Federation can be represented in the form of a recursive system of simultaneous equations.

Based on the method of eliminating quasinemeasurable variables at a critical value of the coefficient of variation $\nu^* = 0.1$, the following 8 characteristics with no significant information were recognised as quasi-unchangeable and excluded from the set of potential explanatory variables: the consumer price index; producer price index of manufactured goods; index of industrial production; the producer price index of industrial goods; official exchange rate of the Ruble to US dollars; the number of shares traded on the Russian stock market; the number of issuers traded on the Russian stock market; the number of crimes committed in the economic sphere.

Functional and weakly bound regressors were identified with respect to endogenous variables based on the method of analysing the matrix of correlation coefficients (Table 2).

2.1 The creation of the econometric model of the indicator y_1 — the value of the conflict assets

With the help of cross-correlation function, lagged variables were created based on the exogenous variables. Lag value τ for variable x_j was defined from $r(y_{1t}, x_{jt-\tau}) = \max(r(y_{1t}, x_{jt-\tau}))$, varying τ from 0 to 12. For instance, the volume GDP for lag x_1 was 8 months. Similarly, lags were defined for the remaining exogenous variables x_j analysed.

Table 1. The results of the study of the Russian M&A market based on the Granger causality test

No	Hypothesis	Fobserv.	Conclusion	General conclusion
1	H1: "The cost of the conflict assets y_1 is not a factor that determines the change in the number of mergers and acquisitions transactions y_2"	8.1523	Hypothesis H_1 is rejected	y_1 is the cause of y_2 (y_2 is not the cause of y_1)
	H2: "The number of M&A translations y_2 is not a factor that determines the value of conflict assets in Russia y_1"	1.1512	Hypothesis H_2 is accepted	
2	H1: "The value of the conflict assets y_1 is not a factor that determines the change in the cost volume y_3 of the M&A market"	8.7567	Hypothesis H_1 is rejected	y_1 is the cause of y_3 (y_3 is not the cause of y_1)
	H2: "The monetary volume y_3 of the M&A market is not a factor that determines the change in the value of the conflict assets y_1"	1.8796	Hypothesis H_2 is accepted	
3	H1: "The number of mergers and acquisitions transactions y_2 is not a factor that determines the change in the monetary volume y_3 of the M&A market"	6.4612	Hypothesis H_1 is rejected	y_2 is the cause of y_3 (y_3 is not the cause of y_2)
	H2: "The monetary volume y_3 of the M&A market is not a factor that determines the change in the number of integration transactions y_2"	1.361	Hypothesis H_2 is accepted	

Table 2. Exogenous variables excluded from the further analysis of the integration activity

y_1 — the value of conflict assets	y_2 — the number of mergers and acquisitions transactions	y_3 — the monetary value of the mergers and acquisitions market
x_6, x_{14}, x_{22}, x_{25}, x_{32}, x_{33}, x_{38}, x_{46}, x_{48}, x_{53}	x_1, x_{12-15}, x_{17}, x_{19}, x_{22}, x_{24-25}, x_{32-33}, x_{36-45}, x_{47-50}, x_{53}	x_6, x_{12}, x_{14}, x_{17}, x_{19-20}, x_{22}, x_{25}, x_{32-33}, x_{38}, x_{41-50}, x_{53}

At the same time, a repeated analysis of the matrix of paired correlation coefficients of the 15 remaining characteristics showed the presence of multi-collinearity. In order to preserve the number of endogenous variables for further economic interpretation, the transition to an orthogonal coordinate system was used [4].

The implementation of the principal component method with the subsequent orthogonal rotation resulted in the five generalised factors that explain 83.04% of the total variance. The regression equation for y_1 — the value of conflict assets, created based on the individual values of the generalised factors $f_1 - f_5$, has the form:

$$\hat{y}_{1t} = 0.51f_1 - 0.62f_2 + 0.29f_3 + 0.29f_4 + 0.31f_5.$$
$$\quad\; (12.17) \quad (-10.58) \quad (7.14) \quad (7.29) \quad (6.03)$$

All regression coefficients in the equation are significant at the level $\alpha = 0.05$. The parameters of the equation obtained show its statistical adequacy: $F_{\text{observ}} > F_{\text{crit}}$ with $\alpha = 0.05$, found under the table of the F-distribution. The standard error was 0.28.

Based on the factor load matrix that characterises the close relationship between the characteristics and the main components, as well as the matrix of eigenvectors with respect to the original variables, the regression equation takes the form:

$$\hat{y}_{1,t} = 0.12 + 0.23y_{1,t-1} + 0.07x_{1,t-8} - 0.02x_{4,t-9} + 0.32x_{24,t-5} +$$
$$+\, 0.19x_{26,t-2} + 0.21x_{29,t-3} + 0.05x_{36,t-8} + 0.14x_{37,t-7} - 0.03x_{44,t-5} -$$
$$-\, 0.07x_{45,t-5} + 0.12x_{47,t-8} - 0.12x_{50,t-6} + 0.07x_{54,t},$$

where $R^2 = 0.8415$, $F_{\text{observ}} = 53.03$, $\hat{s} = 0.39$.

To investigate the presence of autocorrelation in the remainder, an asymptotic criterion of the Breusch–Godfrey serial correlation was used, which is based on the idea that if there is a correlation between neighboring observations, then it is natural to expect that in equation (3) the coefficient ρ turns out to be significantly different from zero [9].

$$e_t = \nu_t + \rho e_{t-1}, \tag{3}$$

where et is the remainder of the regression equation.

According to available data, the coefficient $\rho = 0.019$. It is not significantly different from 0, therefore there is no autocorrelation in the remainder.

2.2 The creation of the econometric model of y_2 — the number of integration transactions.

The analysis carried out made it possible to reveal that since the instant in time $t^* = 69$ (September 2008) a structural change takes place in the character of the dynamics of the indicator under study. This instant in time is characterised by the beginning of the financial and economic crisis in Russia. Buyers and sellers have different reasons for mergers and acquisitions during the periods of economic

growth from reasons for integration during the financial and economic crisis [11] that cannot influence the integration activity of Russian companies. Under the conditions of the financial and economic crisis the imbalance of supply and demand in the M&A market affects the formation of the reasons for integration.

In econometrics, several formalised tests have been developed that allow one to determine the presence of a structural shift in the available data. In this paper, the Chow test was applied, which showed that a structural shift was observed in September 2008. Therefore, the parent population was divided into two parts in terms of improving the model quality relative to the instant in time $t^* = 69$.

Further, with the use of the cross-correlation function, the lag variables were created based on the exogenous variables. Thus, the lag for x_7 — the deficit/proficit of the consolidated federal budget is 7 months. The lags for other exogenous variables x_j were created similarly.

The analysis of the matrix of paired correlation coefficients showed a high multicollinearity in the independent variables. The approach to maximise the predictive power of regression models [1] has revealed that a reduced set of indicators can contain 6 endogenous variables: x_{10}, x_{16}, x_{18}, x_{20}, x_{31}, x_{54}.

To use the entire set of observations in the quantitative volume model of the mergers and acquisitions market, a dummy variable ut was used that takes the values 1 for all $t < t^*$ and the value 0 for $t \geq t^*$, i. e.

$$u = \begin{cases} 1, & t < t^* \\ 0, & t \geq t^*, \ t^* = 69. \end{cases}$$

The discrete nature of the dependent variable affords ground to assume that linear models that connect the number of mergers and acquisitions transactions with the levels of the factors accompanying them will not be entirely adequate to actual data because the calculated values $\hat{y}_{2t}$ can take both integer and fractional values. Count data models, in particular the Poisson regression model are more acceptable in such situations:

$$Y_i = e^{\beta'' x_t + \varepsilon_t},$$

i. e. it is assumed that the number of events y_t is distributed according to Poisson's law with the parameter $\lambda_t = e^{\beta x_t}$.

The maximum likelihood method was chosen to create Poisson multiple regression (calculations were carried out using the Matrixer package). As a result, the following model count data was obtained:

$$\ln \hat{y}_{2,t} = \underset{(4.02)}{2.03} + \underset{(6.02)}{0.11} \ln y_{2,t-1} + \underset{(4.47)}{0.05} \hat{y}_{1,t-1} -$$

$$- \underset{(-8.05)}{0.08} x_{16,t} + \underset{(5.27)}{0.003} x_{31,t} + \underset{(4.01)}{0.12} x_{54,t} + \underset{(3.53)}{0.01} u_t.$$

The likelihood ratio criterion was used to test the hypothesis of the significance of Poisson regression. Since $\chi^2_{\text{observ}} = 62.37 > \chi^2_{\text{crit}}(0.05; \nu = 1) = 3.84$, then the created Poisson regression equation is significant as a whole.

According to the available data, the pseudo-coefficient of determination $R^2_{\text{pseudo}} = 0.8423$, which shows that 84.23% of the variation in y_2 is due to the factors included in the model. The Akaike information criterion, which takes into account the requirement of the increased model accuracy and the reduced number of model parameters, was AIC = 8.03.

The asymptotic criterion of Breusch–Godfrey serial correlation showed the absence of autocorrelation in the remainder. To check whether the remainders of the created model count data belong to the Poisson distribution, the following property was used: the variance of a random variable distributed according to a Poisson law is equal to its mathematical expectation:

$$M[y/x_t] = D[y/x_t] = \lambda. \tag{4}$$

At that time if the values $M(\varepsilon_t)$ and $D(\varepsilon_t)$ are equivalent, then this may serve as an argument in favor of the hypothesis of a Poisson distribution of remainder; the sharp difference in these characteristics, on the contrary, testifies against the hypothesis. Since $M(\varepsilon_t) \approx 2$ and $D(\varepsilon_t) \approx 1.43$ then the hypothesis of the Poisson distribution of the remainder is accepted that testifies the model adequacy.

The calculation of the average marginal effects (Table 3) showed that the value of the conflict assets and the number of mergers and acquisitions trans-actions related to the previous instant in time has the maximum impact on y_2. Moreover, the number of criminal cases related to the crimes committed during illegal seizures of property complexes of legal entities, as well as property and non-property rights of enterprises (raiding) also has a direct impact on y_2.

The calculation of average marginal effects also showed a unidirectional change in the number of integration transactions and overdue creditor indebt-edness, as well as overdue indebtedness for loans and borrowings among large and medium-sized enter-prises. This can be explained by the fact that the man-agement of companies that have fallen into a crisis situation has two options: bankruptcy or business sale, and in most cases they prefer the second one.

Table 3. Average marginal effects for the Poisson regression model

$\dfrac{\partial M[y_{2,t}/y_{2,t-1}]}{\partial y_{2,t-1}}$	0.23054	$\dfrac{\partial M[y_{2,t}/x_{18,t}]}{\partial x_{18,t}}$	0.00653
$\dfrac{\partial M[y_{2,t}/y_{1,t-1}]}{\partial y_{1,t-1}}$	0.06042	$\dfrac{\partial M[y_{2,t}/x_{20,t}]}{\partial x_{20,t}}$	0.18579
$\dfrac{\partial M[y_{2,t}/x_{16,t}]}{\partial x_{16,t}}$	-0.1503	$\dfrac{\partial M[y_{2,t}/x_{54,t}]}{\partial x_{54,t}}$	0.27193
$\dfrac{\partial M[y_{2,t}/u_t]}{\partial u_1}$	0.0321		

At the same time, it is interesting that the nature of the dependence of the number of mergers and acquisitions transactions on the share of unprofitable

enterprises is the opposite. This may be because a very popular way of seizure and acquisitions via the bankruptcy procedure was not used so often in the period under study. This results from the fact that a potential bankrupt company ceases to function in a normal mode and attention to it weakens.

2.3 The creation of the econometric model of y_3 index number — the cost of integration transactions.

The analysis revealed that, starting from the instant in time $t^* = 65$ (May 2010), a structural change occurs in the character of the dynamics of the indicator under study resulting in a change in the trend that describes this dynamics. This instant in time is characterised by the starting of changes in the global general economic situation and global factors.

The Chow test was used to test the hypothesis and it showed that it is advisable to divide the initial population into two parts for the further analysis from the point of view of the improved quality of the model relative to the instant in time $t^* = 65$ (January 2003–May 2008 and June 2008–December 2015).

As in the case of y_1 and y_2, the analysis of the matrix of paired correlation coefficients showed the presence of multicollinearity between independent variables. The use of the method to maximise the predictive power of the regression models allowed us to identify that the reduced set of indicators for y_3 contains 10 endogenous variables: x_1, x_{15}, x_{16}, x_{18}, x_{24}, x_{26}, x_{31}, x_{36}, x_{37}, x_{54}.

A dummy variable z_t, which takes the values 1 for all $t < t^*$ and the values 0 for $t \geq t^*$, was included to use the entire set of observations in the model of the monetary value for the mergers and acquisitions market, i.e.

$$z = \begin{cases} 1, & t < t^* \\ 0, & t \geq t^*, \ t^* = 65. \end{cases}$$

The resulting regression equation, which was created by the method of incremental inclusion of variables , can be represented as:

$$\hat{y}_{3,t} = -\underset{(-2.97)}{8.03} + \underset{(6.03)}{1.53}\,\hat{y}_{1,t} + \underset{(2.78)}{0.12}\,\hat{y}_{2,t} - \underset{(-2.92)}{0.03}\,x_{16,t} -$$
$$-\underset{(-3.37)}{0.023}\,x_{24,t-9} + \underset{(3.82)}{0.04}\,x_{37,t-7} - \underset{(-2.42)}{0.04}\,x_{54,t} + \underset{(2.49)}{2.05}\,z_t.$$

$$R^2 = 0.8907, \quad F_{\text{observ}} = 19.02, \quad \hat{s} = 0.37.$$

The equation created indicates that the following indicators such as the proportion of unprofitable organisations in the total number of organisations in the industry, the volatility of the stock market, the volume of investments from foreign investors, and the number of criminal cases related to raiding influence y_3 the monetary value for the mergers and acquisitions market. At the same time, the dummy variable z_t, which characterises the structural instability of the resulting indicator y_{3t}, is the most direct influence.

The asymptotic criterion of the Breusch–Godfrey serial correlation showed the absence of autocorrelation in the remainder. It can be seen from the histogram of the remainders that the remainders obey the normal distribution law.

Thus, the model of the Russian market of mergers and acquisitions can be represented in the form of a system of equations:

$$
\begin{cases}
\hat{y}_{1,t} = 0.12 + 0.23 y_{1,t-1} + 0.07 x_{1,t-8} - 0.02 x_{4,t-9} + 0.32 x_{24,t-5} + \\
\quad + 0.19 x_{26,t-2} + 0.21 x_{29,t-3} + 0.05 x_{36,t-8} + 0.14 x_{37,t-7} - 0.03 x_{44,t-5} - \\
\quad - 0.07 x_{45,t-5} + 0.12 x_{47,t-8} - 0.12 x_{50,t-6} + 0.07 x_{54,t}, \\
\qquad\qquad\qquad\qquad \text{where } R^2 = 0.8415, \ F_{\text{observ}} = 53.03, \ \hat{s} = 0.39; \\
\ln \hat{y}_{2,t} = 2.03 + 0.11 \ln y_{2,t-1} + 0.05 \hat{y}_{1,t-1} - 0.08 x_{16,t} + 0.003 x_{31,t} + \\
\quad + 0.12 x_{54,t} + 0.01 u_t, \\
R^2_{\text{pseudo}} = 0.8423, LR = 63.25, \hat{s} = 0.25; \\
\hat{y}_{3,t} = -8.03 + 1.53 \hat{y}_{1,t} + 0.12 \hat{y}_{2,t} - 0.03 x_{16,t} - 0.023 x_{24,t-9} + 0.04 x_{37,t-7} - \\
\quad - 0.04 x_{54,t} + 2.05 z_t, \qquad \text{where } R^2 = 0.8907, \ F_{\text{observ}} = 19.02, \ \hat{s} = 0.37.
\end{cases}
$$

The resulting system of interdependent econometric equations expresses their new content through their structural form the interrelationship between the phenomena; this content is characterised by the mutual influence of dependent and independent variables on each other, as well as allows for a deeper study of the causes of the relationship underlying the variation of the resulting variables.

3 Conclusion

Each of the equations of the system obtained includes the number of criminal cases related to unfriendly and illegal acquisitions. These processes have an objective basis. Tendencies to increase the size of the money supply, which is the accumulation of both individuals and organisations, are characteristic for the modern Russian economy. The free money supply overhangs the mark, seeking an effective application for itself including via the new businesses acquisition that are often associated with criminal risks.

The application of the results of the calculations performed for the period from January 2003 to December 2015 allows one to see the opposite relationship between the volatility of the stock market and the value of the market for mergers and acquisitions. Thus, the increased uncertainty in the capital market reduces incentives for Russian holdings to implement investment projects, including integration projects. At the same time, the increased uncertainty in the stock market increases the value of conflict assets.

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