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CONSTRUCTION OF A MODEL FOR INTERNAL AUDIT VIA ECONOMIC AND MATHEMATICAL METHODS

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ABSTRACT

The paper shows the method of applying economic and mathematical methods in the internal audit for optimal formation of estimation values. The method was tested with the use of a data array of ten major Russian companies engaged in manufacturing automobiles, trailers and semitrailers. Upon construction of the model, such factors as revenue, labor costs, other expenses and the company's appearance as a defendant in court were taken into account, since it was assumed that there would be a positive relationship between these indicators and the company's estimated values. The linear regression model was constructed after confirming the positive relationship between the selected indicators and the estimated values. Further an audit of the optimality of the estimated liabilities of PJSC AVTOVAZ (the biggest manufacturer of Renault®-Nissan® Alliance and one of the world biggest automobile plants) was carried out on the basis of this methodology: the necessary values were substituted into the regression model obtained. The paper also discloses the methodology for evaluating the internal control system of PJSC AVTOVAZ; for this purpose, a formula was used to evaluate the result of the internal control system application as a sum of losses prevented. With the help of this model, the effectiveness of the internal control system in the company was evaluated and the optimal values of the internal control system level and possible financial losses that correspond to this level of organization of the accounting and internal control system were determined.

1. INTRODUCTION

Today, it is the growing importance of economic and financial analysis that is the characteristic feature of the audit. Those criteria contribute to the significant improvement of the audit quality. The analytics is gaining more and more importance for the audit, what speaks for the need for deepening the available knowledge.

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The methodological basis for internal audit today is economic analysis, which exercises control functions. Clearly, there is a close and strong relationship between economic analysis and audit. It is the information base, as well as the set of methods used, that are the most frequent contact points for these categories.

As a rule, economic analysis uses the following two areas in its methodology (Novikov, 2013). One of them is the use of relative, absolute, and also average values. In addition, there are used such methods as comparison, method of chain substitutions, groupings, index method, etc. That is, as we see, the methods of statistics, analysis, mathematical elements, for example, correlation or regression, are mainly used (Inglehart and Welzel, 2009).

Economical and mathematical methods, including the econometric ones, may be widely used for internal audit, especially, when checking optimal estimated values, as well as in the evaluation of a company's internal control system (Kharisova and Lytneva, 2016). To confirm the feasibility of applying the econometric analysis methods in the internal audit, a linear regression model of the dependence of estimated liabilities on various factors was constructed. In the case of statistical significance, this model can be used to improve the efficiency of conducting analytical procedures for internal audit. The quantitative estimation was carried out on the basis of Microsoft Excel.

2. METHODS

The information necessary for the construction of the model was formed by us on the basis of data from ten Russian companies operating in the manufacturing of cars, trailers and semitrailers (Table 1).

Table 1: Initial data for the correlation analysis (thousand rubles)

Company name	Labor costs	Other expenses	Revenues	Defendant
PJSC "AVTOVAZ"	18,379	8,671	233 826	11.2
JSC "TFK" KAMAZ "	13 453	8,051	145 217	13.6
PJSC "GAZ"	10 842	5 115	137 934	43.7
JSC "PA" ELAZ "	9,399	5,625	101,456	7.4
JSC "NOVOSIBIRSKIY AUTOMOTIVE PLANT"	11 155	6 577	109 621	15.9
CJSC "Cheboksary ENTERPRISE" SESPEL "	7,506	6,540	98,095	12.1
JSC "SAST"	13,298	10,452	112 843	9.5
OOO "PKK" ELECTROMASH "	14,561	9,767	129,003	27.7
LLC "FORTUNA"	12,354	8,053	125,087	0.6
JSC "Combine of automobile vans"	13 576	8,692	133 490	4.9

For the econometric analysis, data from only one industry was used, since it was assumed that companies in the same industry have a similar production structure, costs and capital, what will allow us to determine the indicators that are typical for a company with medium values of statistical indicators and apply their values later in analytical procedures of internal audit.

Information on the values of financial performance of the organization for 2017 was used to build an array of data. Data on these indicators are given in Table 2.

Table 2: The main characteristics of explanatory variables (thousand rubles)

Indicators	Average value	Median	Maximum	Minimum
Labor costs	12,452	12,826	18,379	7,506
Other expenses	7,754	8,052	10,452	5 115
Revenues	132,657	127,045	233,826	98,095

The first task which has been solved in the process of research was to determine the significance of the model as a whole and the factors forming it.

To verify the assumption of the significance of the factors, a multiple linear regression model of the following form was constructed:

Reserve = a $_0$ + a $_1$ * labor costs + a $_2$ * defendant + a $_3$ * other expenses + a $_4$ * revenue + ε

where a $_0$ is a constant;

ε - noise (random error);

- reserve - dependent variable that determines the amount of short-term and long-term assessment obligations.

The following indicators were taken in the capacity of explanatory variables,:

- labor costs - the organization's costs of labor (million rubles). This variable was included in the regression, as it includes the costs for the forthcoming payment of employee's leaves, annual remuneration, and year-end remuneration. The positive dependences of the investigated variable on this factor were assumed;

- Defendant is a binary variable characterizing the organization's participation in arbitration disputes as a defendant for the analyzed period (2017). An organization's appearance as a defendant in litigation means that it can be prosecuted in the form of a fine and may generate an appraisal obligation in a given period. This variable is equal to 1 if during the year 2017 the organization appeared as a defendant in arbitration disputes, and 0, if not. The positive dependence was assumed:

- Other expenses - other expenses, million rubles. A number of other expenses of the organization falls under the definition of estimated liabilities, for example, obligations to penalties from contractors, commitments to decommissioning of facilities, etc. Estimated liabilities can be used to pay off these costs. Since these costs may be repaid at the expense of previously established reserves, a negative correlation between these variables is assumed;

- revenue - revenue (net) from sales, million rubles. Revenue was included in the regression, as it has a direct influence on the value of provisions for future expenses, being one of the sources of their formation. In addition, the organizations of the automotive industry often form reserves for warranty repairs and warranty service, and the expected organization's expenses for their formation depend on the revenue. Positive dependence of the value of the estimated liabilities on this variable was assumed.

All independent variables were previously checked for surges, inadequate values or errors in data, and such artifacts were not detected there.

Also, the explanatory variables were checked for multicollinearity. An analysis of the correlation coefficients showed that there was no multicollinearity (Table 3). There was a high correlation between some indicators, but these values are not critical.

In order for the results of subsequent tests to be adequate, it is necessary to check the model for

heteroscedasticity. For this, White's test was conducted. Coy (X.e) = 0, this means that the regression residues are homoscedastic, i.e. in our case, the P statistics (23.92) were larger than the P-critical value (5.5 (9).

Table 3: The correlation matrix

	Defendant	Labor costs	Revenues	Other expenses
Defendant	1.0000	-0.0640	0.0524	-0.3251
Labor costs	-0.0640	1.0000	0.8380	0.6663
Revenues	0.0524	0.8380	1.0000	0,2545
Other expenses	-0.3251	0.6663	0,2545	1.0000

Otherwise, heteroscedance would take place, and standard errors in the model would not be evaluated correctly, what would lead to distorted test results. To prevent this, White's corrections (for recalculation of standard regression errors) and a two-step control method are applied.

Next, we could begin to analyze the model. The regression equation has the form:

Reserve = 1779.08 - 0.006 1 * labor compensation - 2.9055 * defendant - 0.0295 * other expenses + + 0.0034 * revenue

Based on the value of P-statistics, one can draw a conclusion about the statistical significance of the model at the 1% level.

Estimates of regression allow us to draw a conclusion about the significance of the influence of individual variables on the value of estimated liabilities. Other costs are significant variable at 3% level of significance, the labor costs are significant at the 0.6% level, and the revenue are of 0.3% level of significance (Table 4). Consequently, the selected regressors influence on the investigated variable.

Table 4: Initial data for the formulation of the regression equation

C	1779,080	856,1831	2,077920	0,092306
Revenues	0,003422	0,010282	0,332873	0,752734
Labor costs	-0,006060	0,176052	-0,034420	0,973871
Other expenses	-0,029470	0,177723	-0,165820	0,874794
Defendant	2,905528	12,36936	0,234897	0,823605

It should be noted also that the results obtained demonstrate the presence of the influence of participation in arbitration disputes as a defendant on the magnitude of the estimated obligations, as it was assumed earlier that this variable was significant. As a result of a detailed analysis of the explanations for the annual financial statements of the companies in the industry in question it was found that some companies reflected estimated liabilities related to penalties imposed by counterparties.

The model showed a positive relationship of the value of estimated liabilities on revenue and a negative dependence on labor costs and other expenses.

3. RESULTS AND DISCUSSION

In order to validate the determination of the estimated values, it is sufficient to an internal auditor to substitute the previously presented indicators in the regression equation with the coefficients obtained, and then compare the value of the estimated obligation obtained from the regression

equation with the indicator presented in the company's accounts. If the internal auditor is in doubt about the optimality of calculating the estimated liabilities in the presence of significant deviations between the indicators compared, then it is necessary to conduct more detailed procedures for checking the estimated values. If there are no significant deviations, then the auditor may to be limited to a minimum set of audit procedures.

Carrying out such procedure for the audited entity of PJSC AVTOVAZ allowed us to obtain the following results presented in Table 5. The deviation of the estimated liabilities value from the result obtained with the use of the model was 2.46%, i.e. it was immaterial. Therefore, the estimated values are determined reasonably.

Table 5: The AVTOVAZ " PJSC " AVTOVAZ "

Indicators	Coefficient	Value
C	1 779.08	1
Labor costs	-0.00606	18,379
Defendant	2,905528	11.2
Other expenses	-0.029470	8,671
Revenues	0.003422	233 826
Estimated liability from model		2,244.86
Estimated liability in reporting		2300
Absolute deviation		55.14
Relative deviation (percent (pct.))		2.46

Thus, based on the calculations performed and the results obtained, it can be concluded that this model has the right to exist, and it is advisable to use it to test the optimality of the estimated liabilities of a really functioning company. It is advisable for an internal auditor to apply this model in its activities when performing an audit task. When conducting an internal audit of the optimality of estimates, it is necessary for the internal auditor to compare the value of the company's estimated liabilities with the indicators of estimated liabilities and with average statistical characteristics. If the value of the estimated liabilities presented in the financial statements differs significantly from the average one, the internal auditor needs to perform additional audit procedures.

As it was mentioned before, it is expedient to apply economic and mathematical methods to evaluate the company's internal control system. The internal control system as a branched organizational structure is a set of units staffed by personnel of the appropriate qualifications and powers that carry out information interaction in the form of direct and backward links that have the appropriate material and technical and information support and are subordinate to the respective executive body (Khismatullin and Kharisova, 2016). According to International Standard on Auditing 315 (revised) "Identification and assessment of risks of material misstatement through the study of the organization and its environment", an internal control system is the processes developed, implemented and supported by persons responsible for corporate governance, management and by other employees of the organization to provide reasonable assurance regarding achievement of the organization's objectives in the preparation of reliable financial reporting, efficiency and effectiveness of the activity and compliance with the applicable laws and normative acts (International professional standards of internal audit, 2012)

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In accordance with international professional standards of internal audit, an internal auditor should assist the organization in maintaining a reliable system of internal control, assessing its efficiency and effectiveness and promoting its continuous improvement (Order of the Ministry of Finance of the Russian Federation, 2016). It should assess the adequacy and effectiveness of control over risks in the sphere of corporate governance, operational activities of the organization and its information systems, in the part of achieving the strategic objectives of the organization; reliability and integrity of information on financial and economic activities; efficiency and effectiveness of activities and programs; preservation of assets; compliance with the requirements of laws, regulations, policies, procedures and contractual obligations.

Evaluation of effectiveness allows us to consider the qualitative and quantitative certainty of individual components of the internal control system and to establish their differences (Gubanov, 1997).

A quantitative evaluation measure for the result of the internal control system operation can be an indicator of the average mathematical expected value of an event or result (Kharisova and Samoilova, 2017). Such assessments are usually based on expert opinions and are subjective in nature.

Next, we will determine the effectiveness of the internal control system of PJSC AVTOVAZ for the period from 2013 to 2017.

Along with many other indicators, the effectiveness of the internal control system can also be determined by the indicator of losses prevented due to the proper functioning of this system (Kharisova and Hamzina, 2016). To determine it, a formula is proposed for estimating the result of the internal control system operation as a sum of losses prevented.

The formula can be represented in the following form (Mkhitaryan, 2012):

- let x be the organizational level of the internal control system;

- $L1(x)$ - loss of the system at the appropriate level of the internal control system. It is logical to take its measurement unit as a percentage of some base value, for example from $L0$, and, therefore, $L0 = 100\%$. The difficulty lies in the measurement of indicators, which are of a qualitative nature rather than a quantitative one;

- $C(x)$ - the cost of maintaining the internal control system. It is very difficult to single out this part of the total cost, but an approximate estimation of the costs on maintaining the internal control system is possible;

- $R(x)$ - the effectiveness of the internal control system expressed through the indicator of reducing losses through the proper functioning of the internal control system.

The proposed indicators allow assessing the effectiveness of the internal control system in companies and to determine the optimal level of the internal control system and possible financial losses corresponding to this level of organization of the accounting and internal control system (Table 6).

4. SUMMARY

As a result of the calculations, the following model for determining the loss values (regression equation) was obtained:

$y = 21.28 + 0.08\ x$.

At the same time, the optimal value of the internal control system level will be:

X optimum = 7.00.

Table 6: Determination of the effectiveness of the internal control system in the PJSC AVTOVAZ

Year	X	X^2	Y	Y estimated	R (x)
2013	7.00	49.00	30.00	25.10	74.90
2014	8.50	72.25	25.00	26.91	73.09
2015	10.00	100.00	23.00	29.07	70.93
2016	14.05	197.40	34.00	36.66	63.34
2017	13.40	179.56	41.00	35.27	64.73
Optimum point	7.00	49.00		25.10	

The following notation is used in the table:

x – a numerical score for the level of organization of the internal control system in PJSC AVTOVAZ (from 2013 to 2017);

y - losses caused by the level of organization of the internal control system (the figures have been obtained as a result of the expert survey processing, or otherwise they are expert estimates);

R (x) - effectiveness of the internal control system

This value x (the level of organization of the internal control system) corresponds to the allowable loss value:

Y (X optimum) = 25.10.

Efficiency in this case will be 74.9%. Given some conditionality of the initial data, it can nevertheless be argued that the best for the company is the level of organization of the internal control system equal to 7 points of the test survey. At the same time, losses amount to 25.10% in comparison with the situation when the company does not have an internal control system or when the control is weak.

5. CONCLUSIONS

Schematically, the diagram of losses and efficiency functions of the internal control system can be represented as follows (Figure 1).

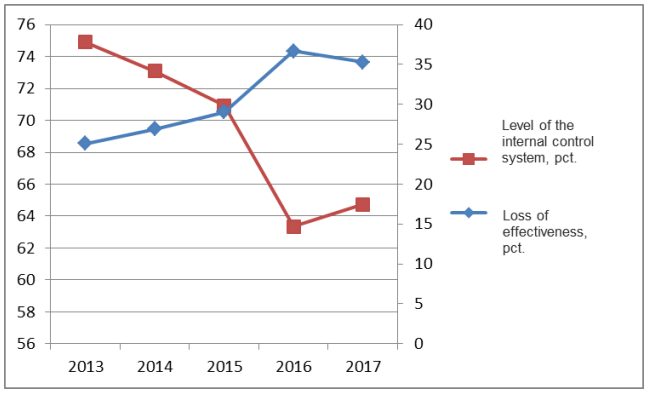

Figure 1: The diagram of losses and efficiency of the internal control system

Thus, the extended application of models and mathematical methods is an objective trend related to the level of development of internal audit. It is impossible not to use them in the internal audit, where there are many different quantitative relationships. Economic and mathematical methods in auditing allow auditors to practice effective approaches to its processes.

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