

## Forecasting Sales of Leasing Companies in the Market of Cargo Vehicles

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**Abstract:** Most economic models are multifactorial. Unfortunately, not all factors can be expressed in conventional units. For example, the “amount of advance payment” can be expressed in rubles, “the lease term” in days but in order to quantify the “package of documents” an expert assessment is required. The proposed methodology allows the authors to not only determine the quantitative estimation of factors but also to analyze their impact on the “sales” and then make a prediction of further development of this important economic indicator.

**Key words:** Sales, forecasting, expert estimates, competitiveness level, correlation and regression analysis

### INTRODUCTION

In recent years, purchasing of vehicles for leasing becomes more and more popular among business entities. The competitors of the Leasing Company “KamAZ” Public Corporation in the Russian market are leasing companies engaged in the leasing of “KAMAZ” class trucks. Thus, the research of competitiveness evaluation of these companies and sales forecasting is particularly important. For this study, the methods of expert assessments and economic and statistical methods were used (Holden *et al.*, 1990; Clark and Fujimoto, 1991). The object of the study was the leasing companies of the Volga Federal District of the Russian Federation (VFD). According to the method developed by the authors, quantification of the VFD leasing companies competitiveness level and affecting parameters was carried out.

### MATERIALS AND METHODS

According to the researchers, it is possible to predict sales of enterprises and organizations of the automotive industry including leasing companies, on the basis of information about their competitiveness level. This information is obtained by the experts with the method developed by the researchers, basing on the single and multi-factor correlation-regression analysis.

### RESULTS AND DISCUSSION

Table 1 shows the average monthly sales and quantitative estimates of the competitiveness level

(obtained by experts) of the investigated leasing companies, based on their last quarterly results. We use the single-factor model built using correlation-regression analysis to predict sales of the leasing companies, depending on their competitiveness level (Table 1) (Porter, 1987; Azoev and Chelenkov, 2000). The analysis showed that the most appropriate model is the linear regression Eq. 1:

$$P = \alpha + bY \quad (1)$$

Because relative error of approximation indicates that a 1% change in the deviation causes average change of the linear function by:

$$E = \frac{1}{n} \sum_{i=1}^n \frac{P_i - \bar{P}}{P_i} 100 = -1.86\%$$

This value is acceptable. Consequently, the linear equation is suitable. Define the parameters of the regression Eq. 1, using the system of equations:

$$\begin{cases} na + b \sum_{i=1}^8 Y_i = \sum_{i=1}^8 P_i \\ a \sum_{i=1}^8 Y_i + b \sum_{i=1}^8 (Y_i)^2 = \sum_{i=1}^8 Y_i P_i \end{cases} \quad (2)$$

Using the data in Table 1 and solving the system of Eq. 2, we obtain the following parameters of the linear regression Eq. 1:

Table 1: Background information to construct a single-factor mathematical model

Leasing companies in VFD	Competitiveness level $y_i$	Volume of sales $P_i$ (million rubles/month)
LC "Kamaz"	0.175	82
LC "Karkade-Leasing"	0.187	90
LLC "Leasing-Trade"	0.165	70
LC "Element Leasing"	0.176	85
LC "Aeroplan"	0.175	80
LLC "Trust-Leasing"	0.118	60

Table 2: Data of the calculated single-factor mathematical model

$Y$	$P_{model}$
0.187	86.54610
0.176	81.98227
0.175	81.56738
0.175	81.56738
0.165	77.41844
0.118	57.91844

$$a = 8.96$$

$$b = 414.89$$

Then, the regression equation takes the form:

$$P = 8.96 + 414.89Y$$

We estimate the closeness of the dependence between the actual sales and the competitiveness level by the determination coefficient:

$$R^2 = \frac{\sum_{i=1}^6 (P_i - \bar{P})^2}{\sum_{i=1}^6 (P_i - \bar{P})^2} \quad (3)$$

We summarize the computational model in Table 2. Using Eq. 3, we obtain the determination coefficient:

$$R^2 = \frac{\sum_{i=1}^6 (P_i - \bar{P})^2}{\sum_{i=1}^6 (P_i - \bar{P})^2} = \frac{517.787}{600.833} = 0.86$$

Indicating a strong influence of the investigated factor on the function. A graph of the dependence of actual sales on the competitiveness level is shown in Fig. 1. According to Table 1 and 2, we can conclude that the data obtained using the single-factor model will have an error not larger than 11% which is acceptable for economic forecasts. Assuming that the maximum competitiveness level of VFD leasing companies will rise from 0.187 points to 0.2, the monthly sales will reach 92 mln. rubles, i.e., it will increase by 5.5 million rubles or 6.2%. Using the same mathematical method, we construct a multi-factor mathematical model for forecasting the VFD leasing companies sales. The factors affecting the sales

Table 3: Background information for the construction of a multi-factor mathematical model

Leasing companies	$Y_2$	$Y_3$	$Y_5$	Volume of sales $P_i$ (million rubles/month)
LC "Kamaz"	0.029	0.024	0.025	82
LC "Karkade-Leasing"	0.036	0.037	0.029	90
LLC "Leasing-Trade"	0.025	0.024	0.021	70
LC "Element-Leasing"	0.025	0.037	0.034	85
LC "Aeroplan"	0.016	0.045	0.017	80
LLC "Trust Leasing"	0.018	0.024	0.014	60

Table 4: Table of factors' deviations from the mean values

Leasing companies	$\Delta Y_2$	$\Delta Y_3$	$\Delta Y_5$	$\Delta P$
LC "Kamaz"	0.0112	0.0052	0.0057	4.1667
LC "Karkade-Leasing"	0.0002	0.0052	0.0107	12.1667
LLC "Leasing-Trade"	0.0042	-0.0078	0.0017	-7.8333
LC "Element-Leasing"	-0.0088	0.0132	-0.0063	7.1667
LC "Aeroplan"	0.0002	-0.0078	-0.0023	2.1667
LLC "Trust Leasing"	-0.0068	-0.0078	-0.0093	-17.8333

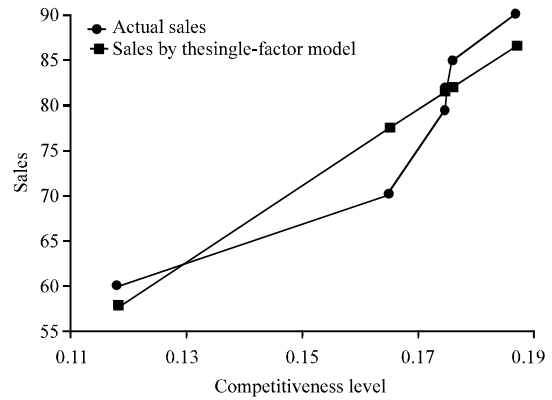


Fig. 1: Graph of the dependence of actual sales on the competitiveness level

are parameters used by the experts to assess the competitiveness level. They are shown in Table 3 (Bolton and Lemon, 1999; Cadotte *et al.*, 1987; Duysters *et al.*, 1999).

According to the expertise results, the quantitative estimates of the parameters are obtained which show that parameters  $y_1$  (advance payment),  $y_4$  (package of documents),  $y_6$  (composition of lease payments) have little effect on sales. Therefore, these parameters were not taken into account in the multi-factor model. Otherwise, all 6 cases (6 leasing companies and 6 parameters) would satisfy the regression equation and the absolute errors would be equal to 0 and the determination coefficients to 1. The most significant parameters were:  $Y_2$  (percentage of price rise per year);  $Y_3$  (maximum term of lease);  $Y_5$  (efficiency of decision-making on financing). The background information for the construction of a multi-factor model is presented in Table 3.

$$P = a + b_1 Y_2 + b_2 Y_3 + b_3 Y_5 \quad (4)$$

To determine the parameters of the Eq. 4, we find deviations from the mean values (Table 4).

$$\Delta P_i = P_i - \bar{P}, \Delta Y_{ij} = Y_{ij} - \bar{Y}_j \quad (5)$$

Then, to determine the parameters  $b_i$  of Eq. 4 by deviations Eq. 5, we use the system of equations: free term  $a$  of Eq. 4 is found by the obtained parameters (Eq. 6):

$$\begin{cases} b_1 \sum_{i=1}^6 \Delta^2 Y_{2i} + b_2 \sum_{i=1}^6 \Delta Y_{2i} \Delta Y_{3i} + b_3 \sum_{i=1}^6 \Delta Y_{2i} \Delta Y_{5i} = \sum_{i=1}^6 \Delta Y_{2i} \Delta P_i \\ b_1 \sum_{i=1}^6 \Delta Y_{2i} \Delta Y_{3i} + b_2 \sum_{i=1}^6 \Delta^2 Y_{3i} + b_3 \sum_{i=1}^6 \Delta Y_{3i} \Delta Y_{5i} = \sum_{i=1}^6 \Delta Y_{3i} \Delta P_i \\ b_1 \sum_{i=1}^6 \Delta Y_{2i} \Delta Y_{5i} + b_2 \sum_{i=1}^6 \Delta Y_{3i} \Delta Y_{5i} + b_3 \sum_{i=1}^6 \Delta^2 Y_{5i} = \sum_{i=1}^6 \Delta Y_{5i} \Delta P_i \end{cases} \quad (6)$$

$$a = \bar{P} - \sum_{j=1}^3 b_j \bar{Y}_j \quad (7)$$

The average values of factors in Table 3. The average values of factors in Table 3: Using the data in Table 1, average values of the factors and applying Eq. 5 we obtain a table of factors' deviations from the mean values (Table 4). The augmented matrix of the system Eq. 6 takes the form:

$$\begin{matrix} 0.00027 & -0.00004 & 0.00019 & 0.07483 \\ -0.00004 & 0.00041 & 0.00008 & 0.36283 \\ 0.00019 & 0.00008 & 0.00028 & 0.25633 \end{matrix} \quad (8)$$

Solving the Eq. 6 with parameters (Eq. 8), we obtain the parameters  $b_j$ :

$$\begin{aligned} b_1 &= -266.37 \\ b_2 &= 684.7813 \\ b_3 &= 899.1922 \end{aligned}$$

Substituting the parameters  $b_j$  and the mean values of factors in the Eq. 7, we obtain the parameter  $\alpha = 41.668$ . Then the regression equation takes the form:

$$P = 41.668 - 266.37Y_2 + 684.7813Y_3 + 899.1922Y_5 \quad (9)$$

Using Eq. 9, we obtain the following data (Table 5). Assess the closeness of the dependence between the actual sales and the  $Y_i$  factors using the Eq. 3, then the coefficient of determination is equal to:

$$R^2 = \frac{\sum_{i=1}^6 (P_i - \bar{P})^2}{\sum_{i=1}^6 (P_i - \bar{P})^2} = \frac{459.021}{600.833} = 0.76$$

Table 5: Data of the estimated multi-factor mathematical model

$Y_2$	$Y_3$	$Y_5$	$P_{model}$
0.25	0.037	0.034	90.918
0.016	0.045	0.017	83.508
0.036	0.037	0.029	83.492
0.025	0.024	0.021	70.327
0.029	0.024	0.025	72.858
0.018	0.024	0.014	65.897

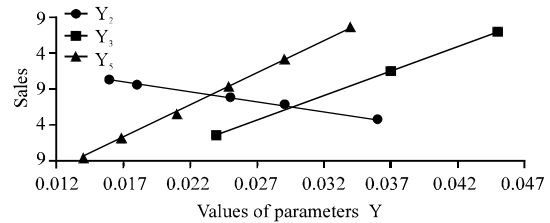


Fig. 2: A graph of the dependence of simulated sales on the parameters of competitiveness

Suggesting that there is a strong relationship between the studied factors and turnover. Dependency graphs of sales calculated by the regression model of factors  $Y_2, Y_3, Y_5$  are shown in Fig. 2. We can conclude that the data obtained using the multi-factor model will have an error not larger than 12% which is acceptable for economic forecasts.

## CONCLUSION

Assuming that the maximum levels:  $Y_2$ : the percentage of price rise per year will increase from 0.025 points to 0.03 points,  $Y_3$ : the maximum term of lease will increase from 0.037 points to 0.04 points,  $Y_5$ : efficiency of decision-making on financing will increase from 0.034 points to 0.04 points, the monthly sales of leasing companies in the Volga Federal District will amount to 97 mln rubles, i.e., will increase by 6.1 million rubles or 6.7%. The prognostic value of the results depends on the economic stability.

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