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The forecasting of operational expenses on railway transport enterprises

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Abstract: The basic methods of economic indexes forecasting on railway transport enterprises have been defined in the article. Three stages of forecasting were determined and described in details. The dominant elements of expenses, such as job salary, traction costs, insurance, repair capital and others were taken into account during research.
Key words: railway enterprises, operational expenses, economic indexes, forecasting, quantitative assessment.

The important direction in legal entity activities nowadays is becoming the forecasting of basic economic indexes, which characterizes its state on the base of correlative – regressive analysis [1].

The investigation of operational expenses and financial indexes, characterizing the condition of a legal entity reveals that their statistical distribution is characterized by the presence of rate variants at different units of the whole complex. The variant of every investigated index is in the close connection and interrelation of other indexes characterizing this complex. The rate of resultant index is influenced by many factors. Thereby the necessity arises of factors study that establishes the index level in such a complex that determines the inclusion of each of them. For this goal the quantitative assessments allowing to outline the factors influence on resultant index are used [2].

The best way to define the close correlation degree is the linear index which is widely known in the literature [3-5]. While counting this index not only rates of individual deviations value from average sum, but also the very value of these deviations is taken into account. However, for the investigation of the operational expenses influence on economic processes there must be rather stable inertial dynamics that in terms of reformations is not observed. At the same time the

empirical base for the research and enterprise economic development comprises the retrospective operational expenses framework on charges elements, i.d. for the research all analytical economic indexes tables according different time periods are available.

Operational expenses must be counted according to the dominant elements of charges that in turn are realized on the accounting of all structural divisions, such as job salary, insurance expenses, materials, power supply on traction, electricity on production needs, other material charges, as well as amortization, assignments to current repair capital and other charges [6].

The main indexes of structural division financial state assessment or detached enterprise of the whole branch are the index of the whole liquidity, the index of urgent liquidity, the index of absolute liquidity, the index of financial independency, Altman's Z-account, the index of capital productivity, the index of fund productivity, the index of own capital turn round, the index of business activities, the cost efficiency of business activities, the cost efficiency of production activities on gross profit, the cost efficiency of production activities on net profit, the cost efficiency on gross profit realization, the cost efficiency on net profit, the cost efficiency of all gross assets, the cost efficiency of the basic capital [7, 8].

The forecasting process comprises three stages. On the first level the number of dominants of the enterprise (or structural division) financial state assessment from many indexes is realized. For this goal we can use the correlative matrix of pair comparison indexes. Below there is a formal introduction of many dominant indexes allotment procedure.

Let **N** be the figure of enterprise financial state assessment indexes, $x_i(t)_I$=1,2, …, **N** is the value of the **i**-index at the moment or during the time period – **t**. The time series $\{x_i(t)\}$, for t=1,2, …., are known. Thus, we define $\mathbf{r_{ij}}$ – the correlation ratio of

i- and j- enterprise financial state assessment indexes.

$$r_{ij} = \frac{M((x_i - M(x_i)) \cdot (x_j - M(x_j))}{G(x_i) \cdot G(x_j)},$$

where **M(x)** is the mathematical expectation of random value **x**, while **G(x)** is an average quadratic deviation.

Further, we'll split indexes on groups in accordance with their similarity character and activities estimation in a definite direction. For example: expenses on salary and social deductions are included in one group. Let's the number of groups to be **M**, for each it will be m=1,2, . M is $X_m=\{x_{i1}, x_{i2,}\ldots, x_{im}\}$ – i.d. multitude of indexes concerning the group **m**.

It's quite natural to suppose that $\sum_{m=1}^{M} i_m = N$ and $X_k \cap X_l = \text{Ø}$, when k≠e, i. d. every index refers to only one group and the common number of indexes in all groups is equal to **N.** In order to define sub multitudes $\{x_m\}$, it's possible to engage experts in corresponding fields of economic analysis.

Further, the dominant indexes in every group are pointed out according to the following condition:

$$i_o^m = \arg\max_i \sum_{x_j \in x_m} r_{ij^2}$$

$$x_i \in X_m$$

i.d. the index possessing the maximum sum determination ratio value with other indexes from the same multitude is chosen.

For the convenience of the further demonstration we designate a new enumeration through $x_1, x_2, \ldots, x_M$.

The second stage provides for reveal of the correlation connections between outcoming indexes which are used by the enterprise management and JSC "Russian Railways" for the management decision making concerning reduction of operational

expenses. Let y_1, y_2, …, $y_к$ be the multitude of indexes used in an operational expenses analysis and decision making concerning their forecasting or reduction.

Thus, we define

$$r(y_i, x_j) = \frac{M((y_i - M(y_j))(x_j - M(x_j)))}{G(y_i) \cdot G(x_j)},$$

where i=1, 2, …, K, j=1, 2, …, M.

The correlative matrix is used $\{r(y_i,x_J)\}$ for reveal of strong and weak relations between indexes $\{x_i\}$ и $\{y_j\}$.

The definition of sub multitude for each index $\{y_j\}$ $X(y_i, x_J) \subseteq \{x_i\}$ is possible to realize either through expert way on the basis of estimation $r(y_i, x_j)$, or by means of correlative relation threshold value between the indexes y_i и x_j, or by Pareto method 80-20.

The third stage provides for the regressive model development $y_i(t)=f(X(y_i))$ and $\mathbf{y_i}$ index forecasting on the corresponding planned period. The function view $f(X(y_i))$ in this scheme realization is not of great significance.

The number of model factors was determined according to the fact that practice worked out the definite criteria allowing to define the optimal ratio between the numbers of features included in the model and the investigated summation volume. According to this criteria the number of features must be 5-6 times less the volume of investigated summation.

Thus, the volume of gathered information on operational expenses changing financial indexes allows to determine the view of functional dependence between indexes [9, 10]. The correlation analysis points out this relation. However, it doesn't show the possible affect on complex factors deviation, which in turn define economic processes of legal entity. The pure analytical dependence of results index from one or several factor features allows to reveal regressive analysis.

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