THE CALCULATION OF THE NORMALIZATION FACTOR IN THE MULTI-PRODUCT MODEL OF INVENTORY MANAGEMENT IN THE SUPPLY OF TWO TYPES OF INPUTS TO MULTIPLE INTERVALS

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Introduction

The most important aspect of financial - economic activity of any enterprise is the effective use of material - industrial stocks.

The normalization factor **k** is defined as the ratio of the maximum total value of stocks Ymax to the sum of their maximum value Y_{Σ} [1]. The value of the normalization factor determines the amount of working capital invested in stocks forming the company, and the error in the evaluation of the normalization factor, and hence, can be costly in the amount of working capital for the company.

The low value of this factor may lead to a lack of financial resources and, therefore, attract borrowed funds and reduce the efficiency of the enterprise.

The aim of this work - calculate the normalization factor in the multi-product model of inventory management for supply of two types of goods with multiple intervals.

Description of the algorithm for calculating the normalization factor.

i	qi	pi	qi*pi	Ti
1.PVC	240 tng/month	170 000 tng/ton	40 800 000 tng	20 days
2.МЕЛ	240 tng/month	42 500 tng/ton	10 200 000 tng	10 days

Table 1: Initial data

qi- batch volume of delivery of species i in kind, pi- unit price of the form i, den. units., Ti- frequency of deliveries species i.

The calculation of the normalization factor.

So, I have a model in which the periods of supply of different types of goods are not equal, but are multiples of each other:

T_2=10 days

T_1=2*10 days=20 days => $T_1=2T_2$.

The optimum value of the normalization factor

$$K^{(2)}_{2;1} = \frac{Y_{\min\max}}{Y_{\Sigma}} = \frac{(q_1p_1)^2 + 2q_1p_1 \times q_2p_2 + 2(q_2p_2)^2}{(q_1p_1 + 2q_2p_2)(q_1p_1 + q_2p_2)} =$$

$$= 1 - \frac{q_1p_1 \times q_2p_2}{(q_1p_1)^2 + 3q_1p_1 \times q_2p_2 + 2(q_2p_2)^2}.$$

The optimum value of the normalization factor = 0.87.

Indicated in brackets superscript normalization factor equal to two, shows that in this model two types of goods are considered. The cost of the parties supply of these goods have arbitrary values and do not match. Subscript normalization factor consists of values m_1 and m_2 [2]. In our case, they are, respectively, 2 and 1, i.e. supply of the second explanation has the frequency of delivery twice more frequent than the first delivery of the goods. If the minimax value of the normalization factor expressed in terms of **γ2**, we obtain

$$K^{(2)}_{2;1} = 1 - \frac{\gamma_2}{1 + 3\gamma_2 + 2(\gamma_2)^2}.$$

and in this case we get 0.87.

This is the best value of the normalization factor for a given ratio of the periods of delivery of goods, and obviously it depends on the ratio of the value of parties supplies γ2.

Optimal relative shift of the second delivery of product $\frac{\theta_2^*}{T_2}$ = 0.89, and the optimal relative shift of the first delivery of product = 0.11.

We calculate the optimal value of the local maximum: 46466666,67 = 4,56 q_1p_1.

Argument γ2 may range from zero to infinity. If γ2 = 0 (there is no the second item), then K = 1. If γ2 tends to infinity, that is there is no first item. By substituting the expression for $K^{(2)}_{2;1}$ we obtain the uncertainty of the form $K^{(2)}_{2;1}$=1- $\frac{\infty}{\infty}$.

To find its value let us determine

$$\lim_{\gamma_2 \to \infty} \left(1 - \frac{\gamma_2}{1 + 3\gamma_2 + 2(\gamma_2)^2}\right) =$$

$$= \lim_{\gamma_2 \to \infty} \left(1 - \frac{1}{\frac{1}{\gamma_2} + 3 + 2\gamma_2}\right) = \lim_{\gamma_2 \to \infty} (1 - 0) = 1.$$

We have a continuous function, which at the edges of its infinite domain is equal to one. This means that there is a minimum value of this function and you need to find out for what value γ2 this minimum is attained. To determine the location of the absolute minimum of the minimax value of the normalization factor, its partial derivative with respect γ2 will be found, as a result we obtain:

$$\frac{\partial K^{(2)}_{2;1}}{\partial \gamma_2} = \frac{d}{d\gamma_2}\left(1 - \frac{\gamma_2}{1 + 3\gamma_2 + 2(\gamma_2)^2}\right) =$$

$$\frac{2(\gamma_2)^2 - 1}{\left[1 + 3\gamma_2 + 2(\gamma_2)^2\right]^2}.$$

Sign of the minimum of the derivative is equal to zero, so let us equate the resulting expression for the first derivative

$$\frac{2(\gamma_2^*)^2 - 1}{\left[1 + 3\gamma_2^* + 2(\gamma_2^*)^2\right]^2} = 0.$$

Obviously, the denominator of the fraction is greater than zero, so we equate the numerator to zero. The first value is $\sqrt{\frac{1}{2}}$, the second value is $= -\sqrt{\frac{1}{2}}$ [2].

At the point we have an absolute minimum of 0.84.

$$K_{2;1}^{(2)*} = 1 - \frac{\gamma_2^*}{1 + 3\gamma_2^* + 2(\gamma_2^*)^2} =$$

The optimum value of the relative shift of the second delivery of goods is equal to 0.59.

$$\frac{\theta_2}{T_2}(\gamma_2^*) = \frac{2\gamma_2}{1 + 2\gamma_2};$$

The study of minimax values using the scripts, complex "1-C" - accounting.

The program for calculating the normalization factor and plotting scripts, "1C-Accounting" was mastered and made.

That is, there was an opportunity to consider the various cases, changing the frequency of multiple deliveries, a period of time and to draw conclusions about the minimum of the minimax normalization factor.

Even at reaching the five time frequency of the shipments, minimax normalization factor becomes greater than 0.9, and the further growth of the multiplicity of periods is faster closer to unity, hence no optimization in these conditions is almost impossible.

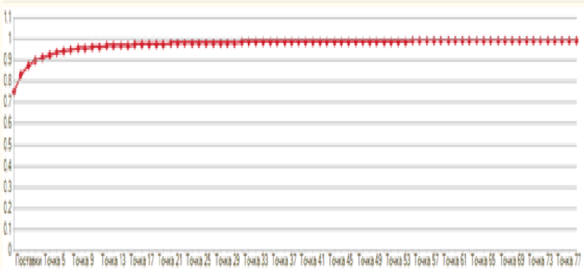

Fig. 1.

The analysis confirms that the absolute minimum of minimax normalization factor in the delivery model of the two types of goods, equal to 0.75, is achieved with equal value of the consignment deliveries of goods $Y_2^* = 1$ and supplies equal periods (m = 1).

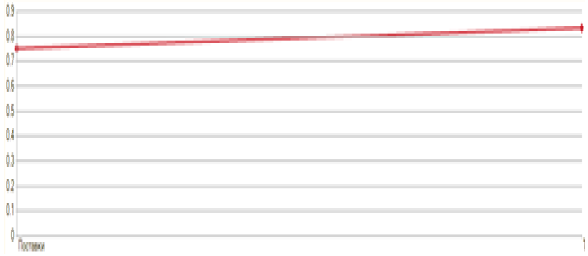

Fig. 2.

Conclusion.

In the course of this work traced an interesting relationship between the multiplicity m periods of supply and the value of optimal ratio of the value of parties. The higher the multiplicity of the second supply of goods compared to the first. More than made his deliveries during one period of the first delivery of the goods, the less should be the cost of the second party supplies of goods in relation to the cost of the first batches of supplies of goods to reach the minimax value of the normalization factor.

The closer the value of m and Y_2^* to the unit, the lower the value of the minimax normalization factor, the closer it is to the absolute minimum minimax normalization factor for the two types of goods, equal to 0.75, which is achieved at the cost of equity and equality of parties supplies periods of time between deliveries.

Obviously, such a model is a supply management for the enterprise the most cost-effective, because it allows to minimize the amount of working capital invested in the formation of reserves. Any deviation from unity m, even at the optimum ratio of the value of parties supplies Y_2^* increases the value of minimax normalization factor up to unity.

References

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