

SOME APPROACHES TO CLASSIFICATION OF SUBJECTS OF FOREIGN ECONOMIC ACTIVITY BY RISK LEVEL

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Abstract

Analyzed two approaches to classification of foreign economic activity subjects by the level of risk. Approaches using as risk measures the probability of customs legislation violation and the expected financial loss are considered.

Keywords: classification, customs risk, k nearest neighbors

1 Introduction

Currently the system of customs risk management in the Republic of Belarus is under development and improvement. As part of the work to a unified identification and analysis, providing for a minimum participation of the subjective human factor to be used probabilistic and statistical methods. One possible approach to risk management at the customs is a division of subjects of foreign economic activity (FEA) into three categories with high, medium and low risk. Appropriate type of customs control can be applied to each of these categories.

Different authors use various measures of customs risks. For example, in the paper [2] as a measure of risk the probability of violation of the customs legislation is used. The probability of violation is estimated using principal component method, cluster and regression analysis. Some authors use expert estimation for risk [3].

On the basis of data on subjects of foreign economic activity of Republic of Belarus who were exposed to check on customs legislation violation we have considered two approaches to classification of subjects by risk level. At the first approach as a measure of risk the probability of violation of the customs legislation was used, at the second — the expected losses for the budget.

2 Legislation violation probability approach

In this approach all subjects of foreign economic activity divided into classes depending on an estimator of probability of a violation of the legislation. For classification on three classes (low, medium and high risk levels) with use of a method of k nearest neighbors [1]. For the training sample the results are given in Table 1. Initially the subjects were distributed by classes with levels depending on the estimators of probability of violation: low for $[0, \frac{1}{3})$, medium for $[\frac{1}{3}, \frac{2}{3})$ and high for $[\frac{2}{3}, 1]$.

Note that only subjects with low risk level are classified more or less well. For the subjects with medium and high risk levels classification is rather unsatisfactory.

		Predicted			Correct, %
		low	medium	high	
Training	low	150	26	31	72.5
	medium	75	45	19	32.4
	high	63	23	51	37.2
	General, %	59.6	19.5	20.9	50.9

Table 1: Risk measure: probability of a violation of the legislation.

3 Expected losses approach

In this approach the risk is measured by means of the expected losses which the customs can incur. Mathematically we can represent the expected loss L_i from subject i in the form $L_i = S_i \cdot X \cdot p_i$, where S_i is the cost of the volume of goods moved by subject i , X is the average income from the detection of violation on a unit of value of the moved goods, in the presence of violation, p_i is the probability of violation for subject i . Having ordered all subjects who had checks (the training sample) by values of the expected losses, we can receive their classification. Initially every class contained equal number of subjects.

For classification of other subjects it is possible to use method of k nearest neighbors. Results of classification for the training sample by this method are given in Table 2. We find them more or less satisfactory.

		Predicted			Correct, %
		low	medium	high	
Training	low	125	68	44	52.7
	medium	26	168	44	70.6
	high	0	14	225	94.1
	General, %	21.1	35.0	43.8	72.5

Table 2: Risk measure: expected losses.

References

- [1] Aivazyan S.A. et al. (1989). *Applied Statistics: Classification and Dimensionality Reduction*. Finansy i Statistika, Moskow. (in Russian)
- [2] Afonin D.N., Afonin P.N., Scribe S.V. (2008). Computing methods of the analysis of customs risks. *Information customs technologies*. pp. 177-212. (in Russian)
- [3] Solovyova I.V. (2008). *Statistical methods for evaluation in the system by the customs risk management: the example of the Southern Customs Department. PhD dissertation*. Rostov-on-Don. (in Russian)