

UDC 656.6:517

## PECULIARITIES OF USING THE NORMAL DISTRIBUTION LAW IN ECONOMIC PROBLEMS

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Keywords: normal distribution law, economic risk curve, three-sigma rule, empirical three-sigma rule.

The normal distribution law is important in many areas of science, including economics, psychology, natural sciences, and social research. What makes the normal distribution law different from other laws is that it is a boundary law, approached by other distribution laws. Regardless of the distribution laws individual elementary errors follow, the characteristics of these distributions in the sum of a large number of addends are leveled out, and the sum is subject to a law close to normal [1,2] This paper analyzes the main distribution laws of continuous random variables compared to the normal distribution, and discusses a series of problems using the normal distribution law in economic planning tasks.

In risk management, when building the economic risk curve, we treated profit as a random variable subject to the normal distribution law. The probability that a random variable with a normal distribution takes a value from the interval  $(\alpha; \beta)$ , is calculated by the formula:  $p(\alpha < X < \beta) = F((\beta - a)/\sigma) - F((\alpha - a)/\sigma)$ , (1) where  $F(x)$  – Laplace function.

We considered the following problem: A company receives mail orders every month. The number of these orders is a random variable with a normal distribution with a standard deviation of 560. In 90% of cases, the number of monthly orders exceeds 12,439. Find the average number of orders received by the company per month.

Solution. The average number of orders is the mathematical expectation of the random variable. According to formula (1), we have:

$$p(12439 < X < +\infty) = F(+\infty) - F\left(\frac{12439 - M(X)}{560}\right) = 0,9$$

$$0,5 - F\left(\frac{12439 - M(X)}{560}\right) = 0,9$$

$$\frac{M(X) - 12439}{560} = 1,282$$

$$M(X) = 13157.$$

Note that when the distribution law of the random variable  $X$  is unknown, but the deviation of  $X$  from its mean value  $a$  (mathematical expectation) is less than  $3\sigma$  (that is, the value of  $X$  deviates from its mean by no more than three times the standard deviation  $\sigma$ ), then it can be assumed that  $X$  has a normal distribution (the "three sigma" rule).

Let's consider the following problem: Let the average income  $X$  per person per month be 8000 UAH. Within what range can we practically guarantee the income  $X$  per person, if the random variable  $X$  has a normal distribution with a standard deviation of 200 UAH.

Solution: We will use the "three sigma" rule, according to which  $X - a < 3\sigma$ . In this case,  $M(X) \approx X = 8000$ ,  $\sigma = 200$ , and we have:  $X - 8000 < 3 * 200$ , then  $-600 < X - 8000 < 600$ ,  $7400 < X < 8600$ . Therefore, it is practically possible to guarantee that the average income per person ranges from 7400 UAH to 8600 UAH.

The study also considers the empirical rule of "three sigma" (2). It indicates that 99.7% of the data observed under normal distribution lie within three standard deviations from the mean. According to this rule, 68% of the data fall within one standard deviation, 95% within two standard deviations from the mean.

### **Conclusion**

The paper discusses the main features of the normal distribution law, which makes it an important tool for data analysis and for building economic risk curves. The conducted research will contribute to improving the quality and efficiency of management decisions.

### **References:**

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- 2.D. Forsyth. Probability and statistics for computer Science. Springer International Publishing. 2018. 367 p.