

Khavruk V. Crime in the Western regions of Ukraine: a one-factor model on the basis of regression equations

Crime investigation can be carried out on the basis of quantitative indicators – by modeling criminological processes. The construction of mathematical models of crime is based on statistics on crimes committed over a specific period in a separate territory. The main purpose of the model is to predict the level of crime on the basis of a formal description of the level of crime for the period under review.

At the initial stage, the definition of the «volume of modeling» of the level of crime, based on the number of people and accounted crimes in the oblasts of Ukraine and in Kyiv in 2017, analyzes the criminogenicity of the oblasts according to the coefficients of crime and criminal activity of the population. It was found that the highest crime rates in Kyiv (241,1548897), Zaporizhia (184,5034222) and Kirovohrad (173,8912366) oblasts. Since Kyiv is among the other cities in Ukraine, it has the largest population and internal migration to the capital, and industrial facilities and other areas of activity of the Zaporizhia and Kirovohrad oblasts are not able to provide the existing population with work and income and this is a decisive factor in the high rates of crime. Calculations of the coefficient of criminal activity of the population show that it has the highest values in Kherson (40,69247598), Sumy (37,65690377), Kirovohrad (37,02381782), Zaporizhia (36,9307188), Mykolaiv (36,07401589), Dnipropetrovsk (35,45594394) oblasts, while in other oblasts it does not exceed 30. It is substantiated that the coefficient of criminal activity of the population does not reflect the objective situation regarding crime in the regions of Ukraine, since there is a low level of disclosure of crimes, and as the main indicator for building a one-factor model the number of whites is chosen lennyh criminal offenses.

The crime rate survey in the western oblasts of Ukraine was carried out on the basis of official statistics for 2015-2017 published by the regional statistics services, according to information provided by the prosecutor's offices of the regions. The choice of western regions of Ukraine for modeling crime is explained by the fact that this region is characterized by a certain stability of social life.

The construction of a one-factorial crime model in western regions of Ukraine on the basis of regression equations is carried out in a logical sequence and includes two stages: 1) elucidation of the dependence of the size of the registered crime rate on the population. 2) calculation of the correlation coefficient. Using the Excel software, we obtain the equations that connect the number of registered crimes with the population in the western regions of Ukraine, namely, regression: linear $y = -7,225665128 + 0,0151342 \cdot x$, index $y = 3,916089004 \cdot 1,000813132^x$, power $y = 0,001164247 \cdot x^{1,287962084}$ and polynomial $y = 17,7505 - 0,01739 \cdot x + 9,15767 \cdot 10^{-6} \cdot x^2$, $y = -60,3836 + 0,1539 \cdot x - 0,0001 \cdot x^2 + 2,4486 \cdot 10^{-8} \cdot x^3$, $y = 685,428 - 2,161898 \cdot x + 0,002495 \cdot x^2 - 1,21975 \cdot 10^{-6} \cdot x^3 + 2,098 \cdot 10^{-10} \cdot x^4$. For the regression equations, Fisher, Student, and determination (R^2) criteria are calculated. As a model for describing crime in the western regions of Ukraine, the equation of polynomials of the 4th degree is chosen ($y = 685,428 - 2,161898 \cdot x + 0,002495 \cdot x^2 - 1,21975 \cdot 10^{-6} \cdot x^3 + 2,098 \cdot 10^{-10} \cdot x^4$) and polynomial 5th degree ($y = 0,0923 \cdot x^5 - 1,9159 \cdot x^4 + 14,689 \cdot x^3 - 50,909 \cdot x^2 + 77,726 \cdot x - 30,713$). The model allows counting the number of crimes, depending on the size of the population, considering the defined confidence intervals.

The statistical data on the number of crimes in the western regions of Ukraine for 2015-2017 shows that a clear tendency for crime reduction is observed only in Khmelnytskyi oblast (7195, 7042, 7627), in other oblasts there is an alternation – the reduction of crime varies to increase and vice versa. Thus, the negative demographic situation in Ukraine is not a factor in reducing criminogenicity, that is, a decrease in the size of the population clearly does not lead to a reduction in crime.

Considering these circumstances, the single-factor model based on regression equations needs to be improved, since it gives a forecast for reducing the number of crimes while reducing the population, as one of the areas for such improvement, it is necessary to consider seasonal fluctuations or separate periods of growth (decrease) in the number of crimes.

Keywords: correlation, crime, correlation index, determination coefficient, crime rate, Fisher's test, population, error, single-factor model, regression, equation, trend.