САМАРСКИЙ УНИВЕРСИТЕТ
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FUZZY MULTIPLE REGRESSION TECHNICAL AND ECONOMIC MODEL OF AIRPORT TERMINAL PASSENGER HANDLING SYSTEM

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Stage 1. Deterministic regression model formation

$$Y_i=\beta_0+\beta_1 x_{i1}+\cdots+\beta_n x_{in}+\varepsilon_i, \qquad i=1,2,\ldots,m$$

Y_i is dependent variable (response);
$x_{i1}, x_{i2}, \ldots, x_{in}$ are independent variables (factors);
$\beta_0, \beta_1, \ldots, \beta_n$ are coefficients (parameters) of the model;
ε_i is random approximation error.

$b_0, b_1, \ldots, b_n$ are unbiased, consistent and effective estimates of coefficients $\beta_0, \beta_1, \ldots, \beta_n$

$$\mathbf{b}=(\mathbf{X}^{\mathrm{T}}\mathbf{X})^{-1}\mathbf{X}^{\mathrm{T}}\mathbf{Y}$$

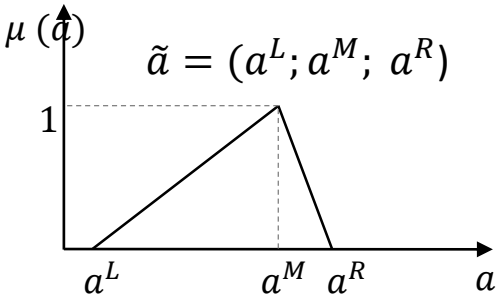
$\mathbf{b}=(b_0, b_1, \ldots, b_n)^{\mathrm{T}}$ is model coefficient vector;
$\mathbf{Y}=(Y_1, Y_2, \ldots, Y_n)^{\mathrm{T}}$ is vector of dependent variables;
$\mathbf{X}$ is matrix of independent variables.

$$y_i=b_0+b_1 x_{i1}+\cdots+b_n x_{in}, \qquad i=1,2,\ldots,m$$

Stage 2. Fuzzy regression model formation

$$y_i = b_0 + \sum_{j=1}^{n} b_j x_{ij} \quad \rightarrow \quad \tilde{y}_i = \tilde{b}_0 + \sum_{j=1}^{n} \tilde{b}_j x_{ij}$$

Triangular fuzzy numbers



$$\tilde{a} = (a^L; a^M; a^R)$$

Defuzzification of triangular fuzzy number by the center of gravity method

$$a^S = \frac{a^L + a^M + a^R}{3}$$

$$\tilde{b}_j = \left(b_j^L, b_j^M, b_j^R\right)$$
$$\tilde{y}_i = \left(y_i^L, y_i^M, y_i^R\right)$$

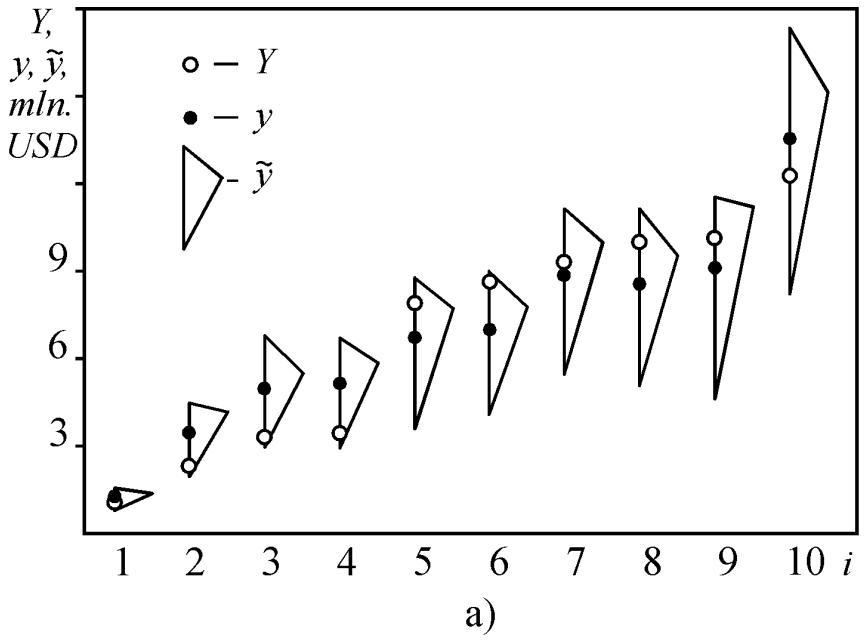
$$b_j{}^S = b_j \rightarrow b_j{}^M = 3b_j - b_j{}^L - b_j{}^R$$
$$y_i{}^S = y_i \rightarrow y_i{}^M = 3y_i - y_i{}^L - y_i{}^R$$

$$b_j^L \leq b_j^M \leq b_j^R$$

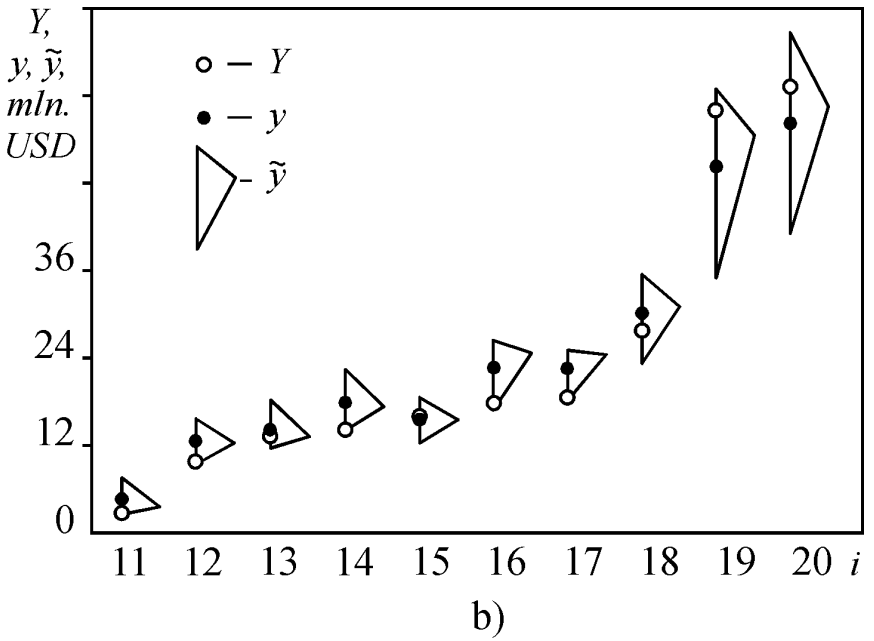
$$\sum_{i=1}^{m} (y_i^R - y_i^L) \rightarrow \boldsymbol{min}$$

$$y_i{}^L = b_0^L + \sum_{j=1}^{n} b_j^L x_{ij} \qquad y_i{}^R = b_0^R + \sum_{j=1}^{n} b_j^R x_{ij}$$

FUZZY MULTIPLE REGRESSION TECHNICAL AND ECONOMIC MODEL



a)



b)

$$\tilde{Y}^{(I)} = (0{,}010;0{,}065;0{,}075)+(0{,}010;0{,}050;0{,}060)x_1+(0{,}290;0{,}300;0{,}310)x_2+ +(0{,}428;0{,}871;1{,}011)x_3+(0{,}218;0{,}318;0{,}418)x_4$$

$$\tilde{Y}^{(II)} = (0{,}100;0{,}500;0{,}900)+(0{,}020;0{,}045;0{,}055)x_1+(0{,}227;0{,}301;0{,}581)x_2+ +(0{,}914;1{,}038;1{,}048)x_3+(0{,}390;0{,}400;0{,}410)x_4+ +(0{,}005;0{,}010;0{,}015)x_5+(0{,}724;1{,}088;1{,}188)x_6$$

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