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Criteria for Solving the Problem of Economic and Mathematical Models Calibration.
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Abstract: The paper considers the problem of constructing criteria for solving the calibration problem (parametric identification) of economic and mathematical models. For a certain type of dynamic models that can be formalized as models of random processes, an approach to constructing a calibration criterion is proposed.

Keywords: economic and mathematical model, model identification, calibration problem.

Many dynamic economic and mathematical models (models of investment and project activities, competition, real business cycles, insurance activities, and others) can be formalized as mathematical models of random processes that have the form

$$y = F(x, a, \varepsilon), \tag{1}$$

where $x = (x_1, x_2, \ldots, x_n)^T$ is the vector of internal variables, $a = (a_1, a_2, \ldots, a_m)^T$ is the vector of model parameters, $y = (y_1, y_2, \ldots, y_k)^T$ is the vector of "observations", and ε stands for the stochastic component. The adequacy of such a model is assessed by comparing the "observations" obtained from it to reference values in accordance with the criteria selected for their analysis. In this case, reference indicators are either real quantitative indicators, or data obtained by means of a comparator (comparison procedure) defined by the goals of modeling.

One of the most important problems in constructing a model of type (1) is the problem of its identification. It is customary to distinguish two types of such problems: structural identification problems (selection of the form F — identification in a broad sense) and parametric identification or calibration problems (estimation of unknown parameters $a_1, a_2, \ldots, a_m$ for a given function F — identification in a narrow sense).

A large number of works are devoted to methods for solving problems of the first type (see, for example, [1]); general approaches to the analysis of local and global structural identifiability have been developed. The problem of calibrating the model is essentially the inverse problem of computer simulation. For the models in question, this problem is stochastic, so to solve it, we need specially constructed statistical criteria that allow measuring of discrepancy between the «observations» and the reference values and take into account the limitations for the estimated parameters values, determined by their economic meaning.

The paper provides two examples of constructing a criterion for solving the problem of model (1) calibration. The first one relates to the stochastic economic and mathematical

model of economic growth proposed in [2] to describe the dynamics of the main macroeconomic parameters (gross output Y, capital stock K, and consumption C)

$$\begin{pmatrix} Y \\ K \\ C \end{pmatrix}_{t+\Delta} = \begin{pmatrix} Y \\ K \\ C \end{pmatrix}_t + \Phi\left(\begin{pmatrix} Y \\ K \\ C \end{pmatrix}_t, A_0, \Delta, \delta\right) \tag{2}$$

Y, K, and C are specified for $t = 0$. In this case, the criterion for solving the calibration problem (simultaneous determination of the parameters A_0, Δ, and δ) can be based on minimizing the product $RMSE_Y RMSE_C$ taking into account the ranges of possible parameter values. The second example relates to the personal income tax scale model. In this case, several possible criteria for model calibration are compared.

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