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Dynamic Models of Economic Development

"Economic research — President Nicolae Ceauşescu pointed out- must tackle more comprehensively the theoretical and practical problems of our economic policy, of the development of productive forces and of production relations, of the improvement of the forms and methods of economic management and contribute to developing the scientific basis of the political economy of socialism" [1].

Thus, a thorough knowledge of the essential aspects of the economy and of its laws is necessary and the models serve the best knowledge of realities. The study of the economic models must be permanently correlated with the political economy. The use of models in economy is a necessity, because "in economic cybernetics just as in cybernetics in general and in the science of management, the concept of model occupies a prevailing place." [1].

The economic models are of two types: structural and previsional. The structural models reflect the internal elements of the economy at a given moment. The previsional elements comprise the parameters defining the future development of the entire economy. The elaboration of a previsional model represents an iterative operation [2].

We consider that the development models are theoretical previsiona models which try to infer the way in which an economy can develop. The world literature of speciality and that of our country [3] comprise many economic models. In the following, we shall present several types of models, considered as representative.

1. ECONOMETRIC MODELS

The econometric models are characterized by the fact that they establish a number of relations between the variables considered as representative for a certain economy. An econometric model is thus a set of relations

[1] Nicolae Ceauşescu: *The Role of Science in the Building of Socialism in Romania*, Editura Politică, Bucharest, 1972, pp. 35.

expressing the interactions between various variables describing the development of an economy.

In general, we speak of mathematical models of the type

$$\Sigma a_{ij} x_j = b_i$$

or

$$AX = B$$

where X represents the vector of the n variables established for describing the respective economy, A — a matrix $n \times n$, and B-a constant vector. The values of coefficients a_{ij} and b_i are inferred from the econometric data. Generally, these models are valid for a term so that after each quarter A and B must be updated. We mention that in this type of models, many coefficients are null in A and B.

At this chapter, we can quote the model of the Belgian economy, the MIT model of the United States economy and, the brief description of some of the models will allow us to infer the characteristic of the econometric models.

1.1. Short-term Previsional Model for the Economy of Belgium

The objective pursued was the elaboration of a model which, based on the data existent in a quarter, should allow the establishment of the national product in the next quarter of the year. The model presentsian important aggregation [7]. Several groups of macroeconomic variables, prces, financial, exogeneous and other variables are distinguished, 30 variables in all. The model comprises 23 relations including the above-mentioned variables or their equivalents calculated at constant prices. Thus, *PNB* represents the gross national product and *pnb* the gross national product calculated at constant prices.

As an example of exogeneous variables, we mention: *CEE* — the industrial production of the European Economic Community ("The Common Market") at fixed prices and *EU* — the industrial production of the United States of America (at constant prices).

As "other variables" we mention *com* — the estimation of orders, *CH*-the percentage variation of the unemployed, *im*-immigrations. As an example of equations describing the model, we quote:

$$pnb^{\bullet}_{L} = 0.183\, L_{t-2} + 0.085 Ch_{t-1} + 0.0041\, com_{t-1} +$$

$$+ 0.032\, EU_{t-1} + 0.164\, CEE_t + 0.468$$

where L represents the liquidities the private sector disposes of and C_r — the credits granted to the private sector. The indices represent the quarter of the year we refer to.

1.2. The Econometric Model "The Federal Reserve — MIT"

The model has been elaborated by a group of economists of Massachusetts Institute of Technology and of the Governors' Office of the Federal Reserves System and covers a quarter of the year. It aims at foreseeing the effects of the monetary policy.

The model comprises three blocks: finance, investments, consumption [4].

1.3. The OBE Model (Office of Business Economics)

This model is a variant of that elaborated at Whartan School of Finance and Commerce, University of Pennsylvania and comprises 36 equations which can be grouped into six categories, linking between them: the components of the gross national product (GNP), the prices and wages, manpower, the components of the income, the monetary variables and other variables. The model covers a quarter of a year [5].

13 identities may be distinguished at the 36 equations: 99 sizes occur in the relations.

The validity of the proposed models are being statistically tested with the aid of indices, a method used in statistics. It results from the published data that in the given conditions (a quarter) the models give data close to those effectively observed.

2. THE PERROUX MODEL

This model belongs to an entirely different category of models. They are rather qualitative models expressing certain trends. [8]

A balance situation is considered in which the total investment I_T, the public investment I_P, the private investment I_p, the public economy E_P and the private one E_p are interposing. By obtaining a complete utilization of all resources available, we write

$$I_T = I_P + I_p = E_P + E_p.$$

Amassing t is the set of resources which are not invested. Economies from the exterior e_e represent net exterior economies.

$$E_T = E_P + E_p + t + e_e.$$

A product is considered which is a function of three resources: natural R_n, human R_h and of production means, in the real capital R_k. The initial product is

$$P_T = (R_n + R_h + R_k)$$

After increasing the considered resources we have

$$P_T + \Delta P_T = R + R'\sigma'.$$

We note with I_i the initial investment. We write

$$I_{T1} + \Delta I_{T1} = (I_i + \Delta I_i) + (\Delta I'_{TQ} + \Delta I'_{TE} + \Delta I_r)$$

where the second bracket represents the set of involving public investments (index T) and of those involved (index E). An investment linked to resources (index r) also appears. Characteristic of Perroux's conception is the idea of involution. This must be understood as follows: an investment in a plant involves other activties, for example commercial, transport ones, etc. As noticed by Perroux, this formulation did not imply the investments for research, development, education and health.

For the national economy, Perroux passes to a model with two sectors: one with a high growth rate and another with a low growth rate. For the sector with a powerful growth, we write

$$\frac{\Delta P_E}{100} = \frac{\Delta I_1 + \alpha_1}{100} \frac{1}{K - \alpha_2}$$

$$\alpha_1 > 0, \quad \alpha_2 > 0$$

where K is the capital function, α_1— the increase of the investment under way, which becomes $I + \alpha_1$ and α_2 increases, through innovation, the efficiency of the capital.

The immediate (second order) involution carried out by the additional public investment is

$$\frac{\Delta P_E}{100} = \frac{\Delta I_1 + \alpha_1 + \alpha'_1}{100} \frac{1}{k_1 - \alpha_2 - \alpha'_2}$$

where α'_1 refers to the "size effect" and α'_2 to the capital efficiency effect.

3. DYNAMIC MACROECONOMIC MODEL (HARROD, DOMAR).

A different category of models tries to grasp the economic reality in its dynamics. These are the dynamic models in which a number of characteristic sizes, variables in time and the relations between them are considered. The models belonging to this category are often described by linear algebraic ratios and by linear differential equations. In certain cases, relations with a delayed argument appear, corresponding, to the delayed translation of investments into productive units. An important characteristic feature may be enunciated for the models described by linear integral-differential equations, with constant coefficients.

Theorem. In any model described by linear integral-differential equations with constant coefficients, the characteristic sizes are linear combinations of time exponential functions, if the characteristic equation has only simple roots.

A model is considered in which the following sizes appear:

k — funds, y — the national income;

j — investment [6].

The characteristic relations are:

$$\frac{dk}{dt} = j$$

$$k = ay$$

$$y = \sigma y.$$

Thus, a relation of proportionality between investments, funds and the national income is admitted. The model is linear without delays, thus it admits exponential solutions:

$$y(t) = y_0 \, exp \, (\sigma t/a).$$

4. THE MACROMODEL IN WHICH THE REPLACEMENT VALUE IS TAKEN INTO ACCOUNT

We introduce the following notations:

b — equipment, k — funds, v — total social product;
d — liquidation; r — the replacement value; c — consumption; s —accumulations; j^G — total investments; j — net investments; y — net product.

The following differential relations result:

$$\dot{b} = j^G - r \tag{1}$$

$$\dot{k} = s \tag{2}$$

which express the following simple facts: the increase of the equipment in time results from the total investments from which the replacement value is subtracted; the increase of funds in time from accumulations exclusively results from accumulations.

A number of relations between the other sizes should also be taken into account, among which we mention:

$$b = xV \tag{3}$$

$$j = j^G - d \tag{4}$$

$$r(t) = j^G(t - \theta) \tag{5}$$

where θ is an average of the replacement length.

If the second is a definition relation, the third one expresses the fact that a replacement value shows a certain delay in θ relation to investments. We underline the medium character of this relation: though the equipment has different wear in time, we admit the existence of a single average value θ. We also write

$$d = b/\theta$$

which allows that by setting out from b and θ, we should infer liquidation d. Further, the linear relations subsist

$$y = v - d$$

$$y = c + s$$

$$s = j$$

and, finally

$$s = \sigma y$$

which expresses the very relation between accumulations and the net social product.

We thus have 10 relations between the 10 condition sizes.

By elimination, we come to a linear differential equation, but with a delayed argument, due to relation (5).

We choose a solution of the form

$$j^G(t) = j_0^G \, exp \, (\omega t)$$

and try to establish the constant values j_0^G and ω.

Resulting is

$$r(t) = j^G(t - \theta) = J_0^G \, exp \, (\omega(t - \theta))$$

thus

$$b = j^G - r = j_0^G(1 - exp \, (-\omega\theta)) \, exp \, (\omega t)$$

resulting thereof

$$b(t) = b_0 + j_0^G \, exp \, (\omega t) \, (1 - exp) \, (-\omega\theta))/\omega$$

where

$$b_0 = b(0) - j_0^G(1 - exp) \, (- \omega\theta)).$$

Considering b, v and d result:

$$v = b/x, \quad d = b/\theta.$$

We can write

$$j_0^G - d = j = s = \sigma y = \sigma(v - d) = \sigma\left(\frac{1}{x} - \frac{1}{\theta}\right) b.$$

We thus have the possibility of establishing a (transcendental) equation from which ω results.

By replacing the expressions of j^G, d and b, resulting is

$$j_0^G \, exp \, (\omega t) - b/\theta = \sigma(1/x - 1/\theta)b$$

where from

$$j_0^G \, exp \, (\omega t) = (\sigma/x) + (1 - \sigma)/\theta)b.$$

If $b_0 = \nu$ we come to equation

$$\omega = (\sigma)\, x + (1 - \sigma)/\theta)\,(1 - exp\,(-\omega\theta) \triangleq A\,\Phi(\omega)$$

which is solved graphically or analytically, by considering equation $A = \Phi$ where

$$A \triangleq \sigma(x + (1 - \sigma)/\theta)$$

$$\Phi(\omega) \triangleq 1 - exp\,(-\omega\theta).$$

5. A MODEL WITH DELAYED EFFECT OF INVESTMENT AND WITHOUT LIQUIDATION]

We note with $j'(t)$ the final investment which, by definition is

$$j'(t) \triangleq \dot{k}(t).$$

We admit that a period θ elapses between the moment when investments start and the moment when the unit starts production. On an average, we invest in period θ

$$j(t) = \frac{1}{\theta}\int_t^{t+\theta} j'\,dt$$

where

$$j(t) = \frac{1}{\theta}\,k\Big|_t^{t+\theta} = (k(t + \theta) - k(t))/\theta.$$

If we admit also relations

$$k = xy, \quad j = \sigma y$$

we dispose of a system of equations from which we infer

$$j(t) = \sigma y(t) = k(t)/x = (k(t + \theta) - k(t))/\theta$$

wherefrom

$$k(t + \theta) = (1 + \theta\sigma/x)\,k(t).$$

We witness a recurrence relation from which we infer that

$$k(t) = k_0(1 + \theta\sigma/x)^{t/\theta} \quad \text{or} \quad \frac{\dot{k}(t)}{k(t)} = \frac{1}{\theta}\,\mathrm{lg}\left(1 + \frac{\theta\sigma}{x}\right)$$

If period θ is small, so that $\theta\sigma \ll 1$, we can use ratio

$$\mathrm{lg}\,(1 + x) \approx x$$

which leads to

$$k'/k = \sigma/x$$

wherefrom

$$\dot{k} = k_0 \, exp \, (t/\tau)$$

thus, the increase of k is approximately exponential in time. If θ is big, a delay appears in the increase of k.

6. MODELS WITH CONSTRAINTS

The linear models are leading to an exponential increase of all sizes including consumption too. Without adopting a Malthusianistic stand, we must outline that the linear models are an approximation. Undoubtedly, many of the resources we possess are limited and they are no longer restored, as is the case with the ore or hydrocarbon deposits. This is a category of constraints one may take into consideration. Another category is represented by subtler elements such as the necessity of maintaining consumption between certain limits. Economists link consumption to utility, a fact which introduces certain constraints in our models.

7. THE UTILITY FUNCTION

The studies of economics and sociology also introduce a utility function to measure the relation between consumption and the so-called "utility". We mention that the literature of speciality comprises many attempts to defining this notion. Certain economists deny the value of these studies. Lately, certain psychologists among whom is R. Bize suggest that the studies be grouped under the name of chreiology, or the science of human necessities. In the following, we shall refer to a model proposed by Ragnar Frisch. These studies must be afterwards correlated with the contemporary concept of "the quality of life".

According to R. Frisch, the utility function is generally expressed in the consumption function. It immediately results that this utility is estimated socially and not individually.

We write:

$$u(c) = \left(\frac{c_m}{c - \bar{c}} - 1 \right)^v$$

where $\bar{c}$ is the minimum level, $c_1 = c_m + \bar{c}$, the maximum level, and c_m the consumption saturation level, where v is a coefficient which is determined econometrically. We impose conditions

$$u(\bar{c}) = \infty, \quad u(c_1) = 0$$

to the effect that utility is extremely great when we are at the minimum level and it is null at saturation.

The flexibility of the utility function is

$$c \triangleq \frac{\Delta u}{u} : \frac{\Delta c}{c} = \frac{\partial u}{\partial e} \cdot \frac{c}{u}.$$

We calculate:

$$e = -\frac{vc^m}{(c-\bar{c})^2}\left(\frac{c^m}{c-\bar{c}} - 1\right)^{v-1} \frac{c}{(c^m/(c-\bar{c})-1)^v} = -\frac{vc^m c}{c^m + \bar{c} - \bar{c}} \cdot \frac{1}{\bar{c}-\bar{c}}.$$

It has been estimated from the econometric studies made that in France, flexibility had the value $e_i = -3.5$, whereas in the U.S.A., $e = -1$. It is known from the same studies that the same utility function subsists for both groups and the public consumption of the French workers was at that moment twice smaller than the public consumption of the workers in the U.S.A. Thus, a system of two equations was obtained

$$\frac{2c^m v c^F}{(c^m + \bar{c} - 2c^F)(2c^F - \bar{c})} = 1$$

$$\frac{c^m v c^F}{(c^m + \bar{c} - 2c^F)(c^F - \bar{c})} = 3.5.$$

Admitting that $c^m \gg 2c^F$, resulting are

$$\frac{2vc^F}{2c^F - \bar{c}} = 1, \quad \frac{vc^F}{c^F - \bar{c}} = 3.5.$$

It results that $v = 0.6$ and $c^F/\bar{c} = 6/5$. We shall introduce a new idea, namely that at moment t, the marginal utility $u(t)$ is equal to the sum of all marginal utilities in the future which may be obtained for a utility unit. Admitting a constant development of the economy, we write

$$u(t) = \frac{1}{x}\int_t^\infty u(\tau)\,\mathrm{d}\tau$$

which is equivalent to

$$\frac{\mathrm{d}u}{\mathrm{d}t} = -\frac{u}{x}.$$

As u is a function of c and of t through c, resulting is

$$x\frac{\mathrm{d}u}{\mathrm{d}c}\bar{c} = -u.$$

Taking into account the expression of u and changing the variable

$$c' = c - \bar{c},$$

is resulting

$$\dot{c} = \frac{c^m - c'}{xvc^m}c',$$

which is a nonlinear differential equation of the type

$$\dot{z} = a + bz^2.$$

It is well known that the integral of this equation is the logistic function

$$z = \frac{A}{1 + B\,exp\,(-t/\tau)}.$$

Indeed, by derivation, we obtain

$$\dot{z} = \frac{-A}{(1 + b\,exp\,(-t/\tau))^2}\,B\,exp\,(-t/\tau)\,(-1/\tau).$$

At the same time,

$$z^2 = \frac{A^2}{(1 + B\,exp\,(-t/\tau))^2}$$

we calculate

$$E \triangleq mz + nz^2 = \frac{nA(1 + B\,exp\,(-t/\tau) + nA^2}{(1 + B\,exp\,(-t/\sigma))^2} =$$

$$= \frac{mA + nA^2 + nAB\,exp\,(-t/\tau)}{(1 + B\,exp\,(-t/\tau)^2}.$$

By equaling E to $\dot{z}$, the coefficients may be identified.
It results that

$$c' = \frac{c^m}{1 + B_1\,exp\,(t/xv)}$$

where $B_1 = exp(t_0/xv)$, and t_0 is the moment when $c'(t) = c^m/2$, that is c' is half the asymptotic value.

8. A GROWTH OPTIMIZING MODEL

Returning to the fundamental relations, we notice

$$s = j = \dot{k} = x\dot{y}.$$

But, similarly,

$$c + s = y.$$

We are thus led to the differential equation

$$c + x\dot{y} = y$$

with constraints $c \geqslant \bar{c}$, $s \geqslant 0$.

In the last equation, the expression of c is known. We introduce a new variable

$$y' = y - \bar{c}$$

so that we write

$$y' - x\dot{y} = \frac{c^m}{1 + B_1 \, exp \, (-t/xv)}.$$

The terms in the left side can be put in the form of a differential of a single term:

$$\frac{\mathrm{d}}{\mathrm{d}t} (y' \, exp \, (-t/x)) = (\dot{y}' - (\dot{y}'/x) \, exp \, (-t/x).$$

We can thus write

$$\frac{\mathrm{d}}{\mathrm{d}t} (y' \, exp \, (-t(x)) = \frac{c^m \, exp \, (-t/x)}{1 + B_1 \, exp \, (-t/xv)}$$

wherefrom

$$y' \, exp \, (-t/x) = -\frac{c^m}{x} \int \frac{exp \, (-t/x)}{1 + B_1 \, exp \, (-t/xv)} \, \mathrm{d}t.$$

The effectuation of the integral depends on the value of v.

It was previously shown that $v \approx 0.6$. It is no flagrant mistake if we consider $v = 0.5$, the calculations being thus much easier to make.

We also change the variable

$$B_1 \, exp \, (-2t)/x) = w^2$$

and resulting thereof

$$w = B_1^{1/2} exp(-t/x)$$

and

$$\mathrm{d}w = -\frac{B_1^{1/2}}{x} \, exp \, (-t/x).$$

The integral in the left side is changed, so that we can write

$$\frac{x}{c^m} \, y' \, exp \, (-t/x) = \frac{x}{B_1^{1/2}} \int \frac{\mathrm{d}w}{1 + w^2}.$$

The left term can be calculated immediately. Resulting are

$$y' = \frac{c^m}{B_1^{1/2}} \, exp \, (t/x) \, \mathrm{arc \, tg} \, w + \bar{y} = \frac{c^m}{D} \, exp \, (t/x) \, \mathrm{arc \, tg} \, (D \, exp(-t/x)) + \bar{y}$$

where $\bar{y}$ is an integration constant value and $D \triangleq B_1^{1/2}$

We can pose the following condition: if $t \to \infty$, $y \to c$.

We calculate

$$\lim_{t\to\infty} \frac{\text{arc tg } D\, exp\,(-t/x)}{exp\,(-t/x)\, D} = 1$$

thus

$$y = c^m + \bar{y}$$

It results that $\bar{y} = 0$, so that

$$y(t) = \frac{c^m}{D\, exp\,(-t/x)} \text{ arc tg } (D\, exp\,(-t/x)) + \bar{c}$$

and

$$y_0 \triangleq y(0) = c^m \frac{\text{arc tg } D}{D} + \bar{c}.$$

We return to equation

$$c + x\dot{y} = y$$

and replace $\dot{y}$ by the approximate expression

$$\dot{y} \approx \frac{y(t) - y(t - x)}{x}$$

where x is measured in time units (usually 3—4 years).
The equation considered becomes

$$c(t) + y(t) - y(t - x) = y(t)$$

wherefrom

$$y(t - x) = c(t)$$

and

$$y(t) = c(t + x).$$

We interpret the results to the effect that both production and consumption move along logistic curves, the only difference between them being the time translation.

We write

$$t'' = exp\,(-t/x)\, D$$

and obtain

$$c = \frac{c^m \text{ arc tg } t''}{t''} + \bar{c}$$

so that

$$\sigma = 1 - \frac{c}{y} = 1 - \frac{c^m/(1 + t'') + \bar{c}}{(c^m/t'') \text{ arc tg } t'' + \bar{c}}.$$

We note

$$t_3 = \text{arc tg } t'', \qquad A = c^m/\bar{c}$$

and write

$$\sigma = \frac{1 - \sin(2t_3)/2t_3}{1 + \dfrac{1}{A}\dfrac{\text{tg } t_3}{t_3}}$$

and, finally

$$y = \bar{c}\left(A\frac{t_3}{tgt_3} + 1\right).$$

We can thus calculate the maximum value of σ, either σ_u, which depends only on A. By calculating we obtain the following values:

A	10	100	500
σ_u	0.63	0.86	0.94

The figures obtained for accumulation are not realistic.

9. GLOBAL MODELS

When studying the evolution in time of a system, sometimes the system is considered as a whole, with an input u and an output y. If the input is zero, the system is called autonomous. The evolution in time of a system can be described in various ways. One of the possibilities is that in which the system is considered globally, its condition being characterized by a single parameter. We shall call these systems global. In the following, we shall give an example of global models, an informational model.

Naturally, it can be admitted that in certain fields, including the economic field, growth implies organization. In its turn, in order to be a characteristic size into a quantitative model, organization must be quantified and measured. From this point of view, we admit that the level of organization of a system is measured by the enthrophy attached to the system. In other words, certain possibilities are attached to the conditions of the system. We also admit that these possibilities vary permanently.

Our affirmation is justified by the fact that in a perfectly organized system, incertitudes become zero so that the system becomes deterministic and also the attached enthropy becomes zero.

We suppose that the system we dwell on belongs to a class of systems in which organization can be measured by a single scalar parameter noted with y, the time function: $y \triangleq y(t)$. We admit that the evolution of the system is described by equation

$$\dot{y} = g(y, h, n)$$

where h is the enthrophy density of the system

$$h(t) = y(t) \lg y(t),$$

and n is a perturbative "force". If we consider the system to be autonomous, $n = 0$.

A simple hypothesis is the linearity of function g in relation to all arguments:

$$\dot{y} = ay + by \lg y, \quad y(0) = y_0$$

which for $y \neq 0$, can be written in the form

$$\dot{y}/y = a + b \lg y.$$

In order to integrate this equation, the variable is changed

$$z = \lg y$$

which leads to

$$\dot{z} = a + bz$$

or

$$\lg (a + bz) = bt + c.$$

In another form, this relation becomes

$$a + bz = d \ exp \ (bt)$$

or

$$z = -a/b + (d/b) \ exp(\ bt)$$

and, finally

$$y = exp \ (A + B \ exp \ (bt)) = Y \ exp \ (B \ exp \ (bt))$$

where $A = -a/b$, $B = d/B$, $Y = exp \ A$.
The initial condition gives

$$Y = exp \ B = y_0$$

that is

$$A + B = \lg y_0.$$

We write

$$y/Y = exp \ (B \ exp \ (bt)).$$

The time evolution of the system depends on the signs of the constant values b and B. If

$$\text{and} \quad b > 0 \quad \text{and} \quad B > 0$$

y/Y increases momentarily in time, beyond any limit.

If

$$b > 0, \ B < 0$$

Y decreases momentarily in time, up to zero.

$$b < 0$$

$w = exp\,(bt)$ decreases in time, up to the limit value $w = 0$, and

$$u = \lim_{t \to \infty} y(t) = Y = y_0\, exp\,(-B).$$

Thus

$$B > 0 \qquad u < y_0$$

$$B < 0 \qquad u > y_0.$$

The values of u are finite and different from zero, for B finite.

This model shows in a simple manner the influence of information on the development of the systems.

The model was proposed by Al. C. Popovici.

* * *

The presented models illustrate some trends expressed by economists in modelling the economic reality. Of course, the problem of economic modelling is ample. In our country, special monographs have been devoted to such problems. In the field of industrial cybernetics and of modelling in generals we mention the studies of professor, dr. engineer Stefan Bîrlea.

We also recommend the monographs written by Dr. E. Dobrescu and Dr. I. Anghel as well as the studies on fuzzy algorithms owed to dr. engineer C. V. Negoiță. Other studies belong to prof. dr. eng. N. Racoveanu, prof. dr. L. Tővissi, dr. E. Țigănescu, mathematician M. Altăr and others.

On a world plane, the amplest modelling is perhaps that initiated by the "Rome Club". We cannot omit the studies of Samuelson, Leontieff, etc. We propose to present critically in other articles the main trends existing in connection with the theory of economic modelling, at present.

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Some conclusions can be drawn from the brief presentation of these models. Thus, the macroeconomic models of an econometric type require a permanent adjustment of the coefficients, being useful only in taking decisions for short periods of time. The other models are the result of idealizations which often considerably diverge from reality, having a euristic value. Political factors, demography, generally extraeconomic, are not implied in such models.

Without diminishing the value of the macroeconomic models, we must realize their restricted validity, which as a matter of fact, happens with any model. But, by constant efforts, the economic models can be improved, especially in the case of the socialist economy.

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