ON INTERDISCIPLINARY APPROACH OF ECONOMIC REALITY

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Abstract

This paper describes the first and second order models in modern investment theory. Interpretations of the decision processes are given and an application is described.

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The evolution of business processes can be represented by different models depending on the complexity of the dynamic process, a single indicator is highlighted mainly by $y(t)$, but a set of indicators are described by $y_1(t)$ … $y_n(t)$ correlated by the model equations both each other or with the factors describing the process evolution: $u_1(t)$ ... $u_m(t)$. The indicators are unknown functions and represent state variables of the associated dynamic system.

Treatment of the economic process as a system highlights factors $u_1(t)$ ... $u_m(t)$ as inputs and indicators $y'_1(t), \ldots, y'_n(t), y_1(t), \ldots, y_n(t)$, like system state variables, as outputs. From the mathematical point of view, the factors are given.
It should be noted that the method of process modeling of economic phenomena is now a reference method for theory and the practice of mathematical modeling.
The model is built as an isomorphic constructs of reality and provides an intuitive yet rigorous image in its meaning of the logical structure of the studied phenomenon. In this way it facilitates the discovery of legitimate links and practically on other routes would be impossible or very difficult to find. Predicting trends is based on the results of such estimates.

Due to the complexity of real processes in building models it is necessary to be adopted some certain limit of detail, retaining the essential elements and key-dependencies. Therefore, the model must always be a simplified representation of reality that would allow actions based on the reasoning about/on the modeling process.

The evolution of the economic capital starting from classic multiplier-accelerator model can be described using second order multiplier. We assume in this model a more general basis for the investment function that contains the difference between the desired capital (K*) and actual capital stock (K), i.e.:

$$K' = I = \alpha(K^*-K),$$

where $\alpha>0$, is the speed of adjustment of capital. For simplicity it was considered that there was no impairment. This equation represents the principle of adjusting the capital stock. Further, it can be assumed K* = rY, i.e., capital stock is proportional to income Y, r is ratio of capital growth / income. It is given by:

$$K' = I = \alpha\,(rY-K).$$

The second order accelerator want to follow the development of the capital stock using not the current level of investment I, but I *which is the expected level. With this in mind let us consider $I' = \beta\,(I^*-I)$, i.e.:

$$I' = \beta(\alpha(K^*-K)-I).$$

Second order accelerator idea is the result of two processes of decision: firstly the manager has to pursue the difference between capital stock and capital in order to adjust the desired level of investment required (knowledge of the certain value of α) and secondly the realization of the investment has to be supervised by the gap between the desired and the current level.

Since $K'' = I'$, by rearranging terms we get:

$$K'' + \beta\, K' + \alpha\beta K = \alpha\beta K^*.$$

We build now a standard macroeconomic model considering consumption function without gaps $C = a + bY$, $0 < b < 1$. From the equilibrium condition $Y = C + I$, is obtained:

$$Y = \frac{1}{1-b}(I+a) = \frac{1}{1-b}(K'+a).$$

Replacing K(= rY in the second order differential equation we get

$$K''+\beta\left(1-\frac{\alpha r}{1-b}\right)K'+\alpha\beta K = \alpha\beta r\frac{1}{1-b}.$$

A particular solution can be found by putting $K = K^1$ = constant, $K^1 = ra/(1-b) = rY$, is the stock of appropriate capital value of static equilibrium Y_c. Using the relation K' = I the following dynamic system is obtained:

$$\begin{cases} K' = I \\ I' = -\alpha\beta K - \left(\beta - \dfrac{\alpha\beta r}{1-b}\right)I + \alpha\beta r\dfrac{a}{1-b}. \end{cases}$$

Let be $c = \alpha\beta$, and $d = \dfrac{r}{1-b}$. Therefore

$$\begin{cases} K' = I \\ I' = -cK - (\beta - cd)I + acd. \end{cases}$$

For c and d fixed, the equations $c = \alpha\beta$, and $d = \dfrac{r}{1-b}$ defines in R^5 a three dimensional subvariety. In all parts of this, the system evolves identically for each fixed value of a. This allows great flexibility in choosing suitable parameters, the designer may take into account the existing opportunities (stock prices, deadlines). When $\alpha = 2$, $\beta = 4$, $c = 4$, $d = 1$, the system under study admits a periodic solution, which means, in economic terms, the development of a business trading cycle. This increases the income producing real multiplier effect. The capital, in turn, produces its effect on the investment accelerator. This occurs in the phase of economic expansion, when K, I, Y increases ($a = 2$, $\beta = 3$, $c = 4$, $d = 1$).

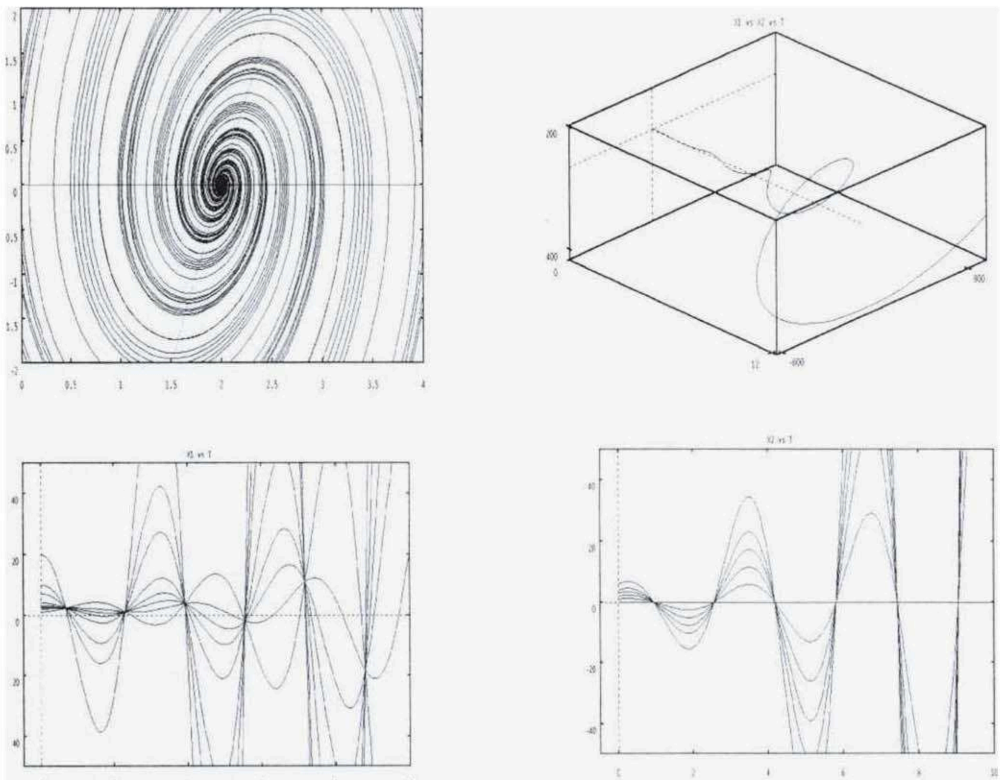

Figure 1. *Evolution of the steady-state system to a state of explosive oscillation*

In general, the activities are more "complex" with both the need for planning, search strategies, and formal and systematic actions for increasing. Economic Area is an area where uncertainty and risk is very high and where planning plays a role important in trying to reduce this uncertainty. In essence, developing strategies in this area requires a clear structure and systematic ways in which objectives can be achieved through a judicious allocation of resources on long or short term. At any step of this kind should be considered the most important aspects of planning that is both product knowledge and knowledge of consumer requirements because "the decision-making is a compromise between the objectives and restrictions".

References

1. Arrowsmit, D.K.; Place, C.M., *An Introduction to Dynamical Systems*, Cambridge University Press, 1990.
2. Beltrami, E., *Mathematics for Dynamic Modeling*, Academic Press, New York, 1990.
3. Braun, M., *Differential Equations and Their Applications*, 3rd ed., Springer, New York, 1983.
4. Hirsch, M.W., Smale, S, *Differential Equations, Dynamical Systems and Linear Algebra*, Academic Press, New York, 1996.
5. Gandolfo, G, *Economic dynamics*, Springer, Berlin. 1996
6. Popescu I.; Ungureanu L., *Paradigma complexității economice*, Editura Expert, Bucureşti 2006.
7. Popescu I.; Ungureanu L., *Previziunea – premise a dezvoltării durabile*, Vol. I, II, Editura Fundației *România de Mâine*, Bucureşti 2008.