

Analysis of a Non-linear Dynamic Financial System

Veronika Novotná^{a,*}, Stanislav Škapa^a

^a Brno University of Technology, Faculty of Business and Management, Kolejní 2906/4, 612 00 Brno, Czech Republic

Abstract

Purpose of the article Some of the major trends of the present include the study of various model situations, orientation in simulated conditions, searching for starting points or optimum solutions, etc.; but in modelling complex relationships within economic systems, it is necessary to take into account the time delay in situations where the dynamic behaviour of the model also depends on its previous states. In this article, the authors analyse the dynamic model expressed by a set of non-linear ordinary differential equations with delayed arguments describing the financial system.

Methodology/methods The economic theory is briefly explained in introductory chapters and serves as a basis for the formulation of the relations of variables that are examined in the article. In the analysis of the problem, the essentials of the theory of functional differential equations are used, especially its part dealing with the solution of differential equations with delay and with the means of numerical mathematics.

Scientific aim The aim of the authors is to analyse the behaviour of the dynamic model of the financial system in terms of its solvability and stability in the event that the model takes into account the impact of the history of the demand for investments. It has been proven that under the assumptions given in the article, our task has only one solution, and this solution is continuously differentiable at the interval being investigated. Furthermore, the stability conditions were formulated and a numerical solution for differently set system parameters presented.

Findings The authors have demonstrated that the system has a complex dynamic behaviour that is significantly affected by the length of the delay of the response to the change in demand for investments; and this is the factor that influences the stability of the system. The results are demonstrated on a specific example, and the behaviour of the model is presented by computer simulation; the Maple system is used to graphically represent the results.

Conclusions The financial system under review is highly sensitive to changes in parameters and its stability is also influenced by the length of the delay of the demand for investments. In the case of a stable situation, the price index and the interest rate are zero, which is inconsistent with normal reality. The results obtained then enable us to model both the impact of history and the extent of its impact, as well as the impact of the changes to all the parameters mentioned.

Keywords: financial system, differential equations, asymptotic stability, simulation, modelling

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* Corresponding author.

E-mail address: novotna@fbm.vutbr.cz.