

Author(s): Januario, C (Januario, Cristina); Gracio, C (Gracio, Clara); Mendes, DA (Mendes, Diana A.); Duarte, J (Duarte, Jorge)

Title: Measuring and Controlling the Chaotic Motion of Profits

Source: International Journal of Bifurcation and Chaos, 19 (11): 3593-3604 NOV 2009

Language: English

Document Type: Review

Author Keywords: Motion of profits; chaotic model; symbolic dynamics; topological entropy; control of chaos

Abstract: The study of economic systems has generated deep interest in exploring the complexity of chaotic motions in economy. Due to important developments in nonlinear dynamics, the last two decades have witnessed strong revival of interest in nonlinear endogenous business chaotic models. The inability to predict the behavior of dynamical systems in the presence of chaos suggests the application of chaos control methods, when we are more interested in obtaining regular behavior. In the present article, we study a specific economic model from the literature. More precisely, a system of three ordinary differential equations gather the variables of profits, reinvestments and financial flow of borrowings in the structure of a firm. Firstly, using results of symbolic dynamics, we characterize the topological entropy and the parameter space ordering of kneading sequences, associated with one-dimensional maps that reproduce significant aspects of the model dynamics. The analysis of the variation of this numerical invariant, in some realistic system parameter region, allows us to quantify and to distinguish different chaotic regimes. Finally, we show that complicated behavior arising from the chaotic firm model can be controlled without changing its original properties and the dynamics can be turned into the desired attracting time periodic motion (a stable steady state or into a regular cycle). The orbit stabilization is illustrated by the application of a feedback control technique initially developed by Romeiras et al. [1992]. This work provides another illustration of how our understanding of economic models can be enhanced by the theoretical and numerical investigation of nonlinear dynamical systems modeled by ordinary differential equations.

Addresses: [Januario, Cristina; Duarte, Jorge] ISEL, Dept Chem, Math Unit, P-1949014 Lisbon, Portugal; [Gracio, Clara] Univ Evora, Dept Math, P-7000585 Evora, Portugal; [Mendes, Diana A.] Inst Super Ciencias Trabalho & Empresa, Dept Quantitat Methods, P-1649026 Lisbon, Portugal; [Gracio, Clara; Duarte, Jorge] Univ Evora, CIMA UE, P-7000585 Evora, Portugal

Reprint Address: Januario, C, ISEL, Dept Chem, Math Unit, Rua Conselheiro Emidio Navarro, P-1949014 Lisbon, Portugal.

E-mail Address: cjanuario@deq.isel.ipl.pt; mgracio@uevora.pt; diana.mendes@iscte.pt; jduarte@deq.isel.ipl.pt

Publisher: World Scientific Publ CO PTE LTD

Publisher Address: 5 TOH TUCK LINK, SINGAPORE 596224, Singapore

ISSN: 0218-1274

DOI: 10.1142/S021812740902502X

ISO Source Abbrev.: Int. J. Bifurcation Chaos

ISI Document Delivery No.: 560PT