

L. Malyarets, O. Dorokhov, A. Voronin, I. Lebedeva, S. Lebedev. Models of microeconomic dynamics: bifurcations and complex system behavior algorithms // VOJNOTEHNI ČKI GLASNIK / MILITARY TECHNICAL COURIER, 2024, Vol. 72, Issue 4. P. 1552 – 1575.

Introduction/purpose: Studying the dynamics of the mutual influence of supply and demand is relevant in connection with the financial losses that arise due to uncertainty in demand and forecast errors. The work aims to build a mathematical model of the dynamics of this interaction for the market of one product. Methods: The paper proposes a mathematical model of the states of the supply-demand system, within the framework of which the processes occurring in this system are considered from the perspective of the methodology of economic synergetics. The mathematical model of dynamics has the form of a system of two differential equations with quadratic nonlinearity. Results: The use of the proposed model to reproduce various dynamic states of market self-regulation processes made it possible to identify the hierarchy of transition from stable dynamic regimes to unstable ones with the appearance of corresponding bifurcations. The main attention was paid to studying the behavior of the system at the boundaries of the stability region. Conclusion: The existence of a saddle-node bifurcation of limit cycles has been revealed, which suggests the appearance of stable self-oscillations in the case of a “soft” cycle and unstable ones in the case of a “hard” cycle. When studying a bifurcation of codimension two - “double zero” - special dynamic structures were discovered, determined by the properties of global bifurcations. This type of behavior is characterized by self-oscillations with a low frequency, which gives rise to the so-called “ultra-long waves” of the economic state.

Key words: dynamics of the supply-demand system, time lag, limit cycle, bifurcation, chaos.

DOI: <https://doi.org/10.5937/vojtehg72-52213>