

On stability and periodic oscillations of an income-capital model with time delay and spatial diffusion

Qiang Zhang¹, Limei Li², Huan Yuan¹, and Zhigang Pan³

¹Civil Aviation Flight University of China

²Sichuan Normal University

³Southwest Jiaotong University

August 13, 2020

Abstract

The paper aims to establish a realistic income-capital model and gives economic conclusions by some mathematical analysis. Firstly, unlike other known models which either neglect time delay or neglect spatial diffusion, our model includes both time delay and spatial diffusion. Secondly, taking the time delay as bifurcation parameter, the stability of positive equilibrium and periodic oscillations are studied by theoretical and numerical analysis under two different boundary conditions. At last, the theoretical results yield the following economic conclusions: 1) For the closed economy or the open economy, there exists a critical threshold of time delay. If the time delay is smaller than the critical threshold, then the economic system will keep balanced at the present state; If the time delay is larger than the critical threshold, the stability of present state will be destroyed, and the periodic oscillations will emerge; 2) The biggest difference between the critical threshold of open economy and that of closed economy is that the former is related to diffusion coefficients, while the latter is independent of diffusion coefficients; 3) The periodic oscillations are spatially homogeneous for closed economy, but are spatially inhomogeneous for open economy; 4) Regional income and capital disparities are more likely to occur in open economies than in closed economies; 5) Results reveal to some extent the causes of the gap between the rich and the poor and also provide insight into why developed economies are more likely to polarize than underdeveloped ones. Our theoretical analysis is based on the center manifold theorem, normal forms and Hopf bifurcation theory.

Hosted file

Kaldor20190403.pdf available at <https://authorea.com/users/350646/articles/475447-on-stability-and-periodic-oscillations-of-an-income-capital-model-with-time-delay-and-spatial-diffusion>

Hosted file

Kaldor20190403.tex available at <https://authorea.com/users/350646/articles/475447-on-stability-and-periodic-oscillations-of-an-income-capital-model-with-time-delay-and-spatial-diffusion>























