

## Economic Development Process: A Compartmental Analysis of a Model with Two Delays

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**Abstract :** In this paper the compartmental approach is applied to build a macroeconomic model characterized by countries. We consider a total of  $N$  countries that are subdivided into three compartments according to their economic status:  $D(t)$  denotes the compartment of developing countries at time  $t$ ,  $E(t)$  stands for the compartment of emerging countries at time  $t$  while  $A(t)$  represents advanced countries at time  $t$ . The model describes the process of economic development and includes the notion of openness through collaborations between countries. Two delays appear in this model to describe the average time necessary for collaborations between countries to become efficient for their development process. Our model represents the different stages of development. It further gives the conditions under which a country can change its economic status and demonstrates the short-term positive effect of openness on economic growth. In addition, we investigate bifurcation by considering the delay as a bifurcation parameter and examine the onset and termination of Hopf bifurcations from a positive equilibrium. Numerical simulations are provided in order to illustrate the theoretical part and to support discussion.

**Keywords :** compartmental systems, delayed dynamical system, economic development, fiscal policy, hopf bifurcation

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