The recent financial crisis and ensuing sovereign debt crisis once again highlighted the great societal value of understanding the potential instabilities in the financial system. Financial instability typically results from positive feedback loops intrinsic to the operation of the financial system. The challenging task of identifying, modeling and analyzing the causes and effects of such feedback loops requires a proper systems engineering perspective that is lacking in the remedies proposed in recent literature. In this project, we developed a signed directed graphs (SDG)-based framework, a modeling methodology extensively used in process systems engineering, as an appropriate framework to address this challenge. The SDG framework is able to represent and reveal information missed by more traditional network models of financial system. This framework adds crucial information to the edges in a network in terms of the direction of flows and relationship between the variables associated with the nodes at the two ends of a directed edge, thereby providing a framework for systematically analyzing the potential hazards and instabilities in the system. This work also discusses how the SDG framework can facilitate the automation of the identification and monitoring of potential vulnerabilities.