Chapter X

FinSim:
A Framework for Modeling
Financial System
Interdependencies1,2

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The size and complexity of financial markets in the United States have created significant payment and settlement interdependencies involving the banking system, money and capital markets, and associated derivative markets. Market participants and the Federal Reserve have for many years pursued measures to strengthen major US payment mechanisms, to increase processing efficiency, and to reduce payment system risks.

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Abstract

We present in this chapter an overview of a financial system model (FinSim) created by the authors at the Los Alamos National Laboratory. The purpose of this model is to understand the impacts of external disruptions to the financial system, in particular disruptions to telecommunication networks and electric power systems; and to model how those impacts are affected by the interactions between different components of the financial system, for example, markets and payment systems, and by individual agents’ actions and regulatory interventions. We use agent-based modeling to represent the interactions within the financial system and the decision-making processes of banks and traders. We model explicitly message passing necessary for execution of financial transactions, which allows a realistic representation of the financial system dependency on telecommunications. We describe implementation of the payment system, securities market, and liquidity market components and present a sample telecommunications disruption scenario and its preliminary results.

Introduction

The global financial system is one of the most complex systems created by mankind. It includes hundreds of different markets around the world, thousands of large institutions and vast numbers of participants. Different components of the financial system are required for other parts of the system to function: For example, stock market operations require the ability to make payments and transfer money in the banking system. The ability to execute transactions on any part of the financial system depends crucially on electric power and telecommunications services and to a lesser degree upon other underlying infrastructures—such as transportation and water. These complex interactions and interdependencies may exacerbate the impacts of natural disasters or terrorist events and are important to understand during crises where parts of the system are entirely disabled or function in a diminished capacity. Although there is a substantial body of research dedicated to modeling of individual components of the financial system, for example, the equity and bond markets, what is lacking is an understanding of how interaction between these components affects the dynamics of the entire system and how this dynamic depends on the state of underlying infrastructures, such as telecommunications.

The global financial system and its subcomponents—financial markets, payment systems, and so forth—are dynamic, nonlinear, evolving systems. New financial products and services are constantly introduced, new strategies for making money are constantly invented, certain players go bust, and others prosper. Money flows
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