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Understanding Systemic Risk in Global Financial Markets

**ARON GOTTESMAN
MICHAEL LEIBROCK**

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*To my wife, Roseann, and my children,
Jaclyn, Victoria, and Michael*

AG

*In memory of my mother, Susan Rachel Raizel
Gottesman z'l*

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Preface

This book provides an in-depth introduction to systemic risk. Systemic risk is the risk that developments in the financial system will disrupt financial stability and the economy. We've written this book because the topic of systemic risk is arguably the most critical issue facing the financial services industry today and one whose impact can spill over into the broader economy with devastating effect on individual consumers and investors.

The Credit Crisis of 2007–2009 was an important catalyst for this book. Yet financial crises have been occurring for centuries, often driven by very similar factors to the Credit Crisis of 2007–2009. One of our objectives is to help you develop a deep understanding of systemic risk through meaningful exploration of the lengthy history of crises and the commonalities across the crises.

We also feel there is a need for systemic risk to be viewed by practitioners as a distinct risk discipline, one that can be analyzed and monitored in an organized and repeatable fashion, much like longstanding risks such as market risk, credit risk, and operational risk have been for decades. Hence, another of our objectives is to provide you the contours of the discipline of systemic risk.

This book can be used either as an introductory text or as an accompaniment to a quantitative treatment of risk. We do not assume that the reader has sophisticated understanding of finance or math, nor have we assumed that he or she has hours to decipher our arguments. Instead, this book provides straightforward, plain-talking explanations that are directly related to those issues that matter most to practitioners. Audiences for this book include:

- Individuals and university students learning about risk management for the first time who do not have extensive math or finance backgrounds.
- Practitioners in “middle-office” and “back-office” roles in financial institutions, such as those in risk management, operations, technology, information security and compliance that require a broad understanding of the types of risks posed by systemically important financial institutions and who have a need to identify such risks to do their jobs.

- Practitioners, regulators, and academics who want to understand how regulation and clearinghouses function as risk-mitigating utilities for the financial industry.

This book consists of 16 chapters and an appendix. Here is a brief summary of the material that is covered in each chapter.

The first three chapters of this book introduce the concept of systemic risk and explore its history. *Chapter 1* provides a high-level introduction to the topic of systemic risk, including definitions provided by industry, academic, and regulatory experts, and explains the importance of enhancing understanding of systemic risk. *Chapter 2* provides a summary of prior systemic events and identifies common drivers of these events based on several hundred years of evidence. *Chapter 3* provides an overview of the events surrounding the Credit Crisis of 2007–2009, which had a devastating impact on the both the financial industry and economies of the United States and Europe.

Chapters 4–6 delve deeper into systemic risk. *Chapter 4* explores one of several theories that help explain why financial crises have been occurring for centuries, including those that address economic cycles, behavioral biases, and the role the human brain plays in risk taking and decision making. *Chapter 5* discusses the critical role that data plays in the effective monitoring of systemic risks, including key industry advancements such as the Legal Entity Identifier and the creation of the Office of Financial Research, aimed at addressing certain information gaps that contributed to the Credit Crisis of 2007–2009. *Chapter 6* defines macroprudential and microprudential oversight and offers important distinctions between the two regulatory oversight approaches.

Chapters 7 and 8 introduce regulatory regimes in various jurisdictions. *Chapter 7* provides an introduction to U.S. financial regulation and the approaches of the various U.S. regulators and introduces the Dodd-Frank Act of 2010. *Chapter 8* turns to international regulatory regimes, providing an introduction to several key international regulators and standards that facilitate international approaches and coordination.

Chapters 9–14 explore in detail many elements of how systemic financial risk is managed. *Chapter 9* delves into the designation of entities as systemically important, including Systemically Important Financial Institutions (SIFIs), Systemically Important Financial Market Utilities (SIFMUs), and Globally Systemically Important Banks (G-SIBs). *Chapter 10* explores the Volcker Rule of the Dodd-Frank Act, which sets prohibitions, requirements, and limitations in relation to the trading and private fund activities of banking entities and systemically risky non-bank financial companies. *Chapter 11* provides an introduction to counterparty credit risk, and studies sources

of counterparty credit risk and how counterparty credit risk is managed. *Chapter 12* explores Title VII of the Dodd-Frank Act, which works to reduce the counterparty exposure faced by participants in the OTC derivatives market through setting mandatory clearing and other requirements. *Chapter 13* explores the Basel Accords—multinational accords that set minimum capital requirements for banks—that were established in order to strengthen the soundness and stability of the international banking system. *Chapter 14* studies the concept of “lender of last resort,” including its benefits, risks, various views of its function, and its application.

Chapters 15 and 16 tie together the concepts explored throughout this book. *Chapter 15* introduces the topic of interconnectedness, explains how this risk manifested itself during the Credit Crisis of 2007–2009, and illustrates the ways in which interconnectedness has become a key consideration in several post-crisis regulatory developments. *Chapter 16* looks ahead to the outlook and likelihood of future systemic events and includes a number of recent examples of top systemic concerns as published by several large financial institutions and regulatory bodies.

This book also includes an appendix that provides a detailed taxonomy and literature review of some of the key quantitative models that are used to measure systemic risk in different ways.

To allow you to test your understanding, each chapter concludes with a number of *Knowledge Check* questions, the solutions to which are provided in the appendix. The *Knowledge Check* questions can be used to ensure absorption of the material both when you learn the material for the first time and also when you review.

We hope this book provides you with a comprehensive understanding of systemic risk!

Acknowledgments

ML

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AG

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Michael Leibrock is managing director, chief systemic risk officer, and head of Counterparty Credit Risk for the Depository Trust & Clearing Corporation (DTCC). Michael Leibrock currently serves as co-chair of DTCC's Systemic Risk Council and as chair of the Model Risk Governance Committee. He has conducted numerous newspaper and magazine interviews on risk topics, as well as several video interviews on *TabbForum.com*, which include "Building an Interconnectedness Risk Program" (Dec. 2016), "Unintended Risks of Regulations" (Dec. 2014), and "The Top Systemic Threats to the Capital Markets" (Aug. 2013). Michael Leibrock holds an MBA in Finance from Fordham University and a doctorate in Finance and International Economics from Pace University's Lubin School of Business. He has previously served as an adjunct professor at New Jersey City University and Monmouth University. Michael Leibrock's prior academic research has covered topics such as predictors of bank defaults, sovereign default analysis, and a doctoral dissertation titled "Systemic Risk and an Extension of the Black Scholes Merton Option Pricing Model for U.S. Banks."

Understanding Systemic Risk in Global Financial Markets

Introduction to Systemic Risk

The topic of systemic risk should be of critical importance to the numerous actors and stakeholders that make up the global financial ecosystem. This includes, among others, financial institutions such as banks, investment banks, and asset managers, financial regulators, policymakers, and central banks, as well as individual investors. It is also important to the general consumer, given that systemic events have the potential of spilling over from the financial system and impacting the real economy. Many historical systemic events have led to national or even global recessions, significant loss of employment, and a spike in both corporate and personal bankruptcies and taxpayer losses. Clearly, the most widely known and recent example of a systemic event was the Credit Crisis of 2007–2009, which involved, among other events, the collapse of the U.S. residential real estate and asset-backed securities markets, as well as the bankruptcy or bailout of many globally recognizable financial institutions, including Lehman Brothers, Bear Stearns, and American International Group (AIG), among others.

Given the high-profile failure or effective failure of these long-established financial firms, combined with the fact that financial crises have occurred with far greater frequency over the last several decades, some people may assume that systemic risk is only a recent phenomenon. However, it is important to understand that systemic events have been occurring for many centuries. Some well-known and relatively recent examples of such events include the U.S. savings & loan crisis, the bursting of Japan's real estate bubble, the Latin American debt crisis, the collapse of the U.S. junk bond market, the failure of hedge fund Long-Term Capital Management, and the bursting of the dot-com bubble.

Before the Credit Crisis the topic of systemic risk was rarely discussed within the financial services industry. Furthermore, organized research on the topic was limited and occurred only within academia and the research divisions of certain financial regulators or central banks. However, given the devastating impact of this event globally and the massive response by

global financial regulators, the focus on systemic risk has skyrocketed over the past five years and is now the subject of regular discussion, analysis, and monitoring by all stakeholders across the globe.

This chapter introduces the topic of systemic risk, explores the many definitions that have been published or discussed in recent years, summarizes the key drivers of historical systemic events, and explains why it is critical that this topic be further analyzed and understood.

After you read this chapter you will be able to:

- Describe the common definitions of systemic risk.
- Understand the key drivers of prior systemic events.
- Explain the different impacts a systemic event can have on the financial industry and real economy.

WHAT IS SYSTEMIC RISK?

The area of systemic risk analysis is still in its very nascent stages and there currently is no single, universally accepted definition employed by those involved in analyzing and monitoring systemic risk. Moreover, as research on this topic evolves over time, it is likely that existing definitions will morph or that new definitions will be put forth by the various constituents who have an interest in this topic. Furthermore, it is important to note that having a single definition of systemic risk is not a prerequisite for studying and enhancing one's knowledge of this topic or benefiting from some of the existing approaches to measuring and monitoring systemic risks covered in this book. To provide some context and a foundation for the remainder of this book, listed here are examples of some definitions publicly communicated in recent years by well-known regulators and academics:

- “Systemic risks are developments that threaten the stability of the financial system as a whole and consequently the broader economy, not just that of one or two institutions.”¹
- “In the context of our economic environment, systemic risk is the threat that developments in the financial system can cause a seizing up or breakdown of this system and trigger massive damages to the real economy. Such developments can stem from the failure of large and interconnected institutions, from endogenous imbalances that add up over time, or from a sizable unexpected event.”²
- “Systemic Risk is the risk of a disruption in the market’s ability to facilitate the flows of capital that results in the reduction in the growth of GDP globally.”³

- “One or more global financial centers are mired in a severe crisis that spans two or more distinct regions, with at least three countries impacted in each region. There must also be a corresponding and significant impact on a composite GDP index.”⁴
- “A risk of disruption to financial services that (i) is caused by an impairment of all or parts of the financial system and (ii) has the potential to have serious negative consequences for the real economy. Fundamental to the definition is the notion of negative externalities from a disruption or failure in a financial institution, market or instrument.”⁵
- “Systemic risk emerges when the financial sector as a whole has too little capital to cover its liabilities. This leads to widespread failure of financial institutions and/or the freezing of capital markets, which greatly impairs financial intermediation, both in terms of the payment systems and in terms of lending to corporates and households.”⁶
- “Credit risk, liquidity risk, market risk and operational risk are often difficult to quantify, and more so when the interaction of different types of risk leads to systemic risks. Systemic risks affect a financial system’s stability when idiosyncratic shock to an individual financial institution generates contagious effects on others in the system.”⁷

One common aspect of these definitions is that to be characterized as a systemic threat, the underlying risk(s) should have the potential to severely impact the financial system and real economy. In contrast to the characteristics of a systemic event, an event that might not rise to the level of a systemic risk is one that may have a significant impact on an industry sector or geographic region, but does not spill over into the broad economy. For purposes of this book we will treat the terms *systemic event* and *financial crisis* as synonymous.

SYSTEMIC RISK DRIVERS

Under the broad topic of systemic risk, there have been a wide range of causes for past events. While these events will be discussed in more detail in Chapters 2 and 3, we introduce this topic by providing some of the more common themes behind the many crises that have impacted countless countries and economies across the world.

One of the earliest recorded crises occurred in the middle of the 1200s and was referred to as a *currency debasement*,⁸ which can be thought of as the predecessor to today’s foreign exchange crisis or devaluation. Occurring during the Middle Ages, when metallic coins represented the primary medium of exchange, currency debasements involved the intentional

significant reductions in the silver content of coins. This action helped provide a critical source of war financing for governments.

Currency crashes have been a significant source of past crises, which we will define as an annual depreciation versus the U.S. dollar or the relevant anchor currency for that time (most frequently the U.K. pound, French franc, or German deutsche mark) of 15% or more. While there are many currency crashes throughout history that exceeded this threshold, the largest single crash was experienced by Greece in 1944.

Another frequent driver of systemic events throughout history is the bursting of asset bubbles. A commonly employed definition of a bubble is a non-sustainable pattern of price changes or cash flows. Historically, many asset bubbles have been observed in the real estate sector, particularly over the past 30 years. Major real estate bubbles have burst in Japan, non-Japan Asia, and most recently in the United States, in connection with the Credit Crisis. The bursting of Japan's real estate bubble in the early 1990s led to the widespread failure of banks and a prolonged period of sluggish growth, which came to be known as the "lost decade."

It is noteworthy that bubbles in real estate and stock markets are often closely linked.⁹ Three prominent examples of such linkages include (i) the fact that stock markets of many emerging market countries are heavily weighted toward real estate and construction companies, reflecting the growth stage of such nations, (ii) the fact that the wealth obtained by successful real estate investors is often invested into the stock market, and (iii) that the same high-net-worth individuals referenced in the second example deploy profits made from stock market increases into additional real estate holdings.

There are longstanding economic theories that posit asset bubbles are fueled by significant increases in the pro-cyclical supply of credit during economic booms. This "easy money" climate facilitated by central banks has contributed to a spike in investor speculation, leverage, and hence unsustainable increases in asset prices, which eventually "burst."

There have also been numerous historical financial crises brought on by the default by governments on both their external debt (e.g., default on payment to creditors under another country's jurisdiction) as well as domestic debt. There were at least 250 sovereign external defaults during 1800–2009 and at least 68 instances of default on domestic public debt. A couple of the most well-known examples of the former include Argentina's 2001 default on \$95 billion of external debt and Mexico's 1994–1995 near default on local debt.¹⁰ The negative impact on a country that defaults on its debt can be significant and long lasting. For example, it took Russia decades to finally resolve its 1918 external default with creditors. In addition, because

of Greece's default in 1826, the country's access to global capital markets was very limited for the next half century.

As one of the goals of this book is to identify tools that will help financial industry participants identify the early signs of a financial crisis, it is worth noting that episodes of sovereign default have exhibited some noticeable macroeconomic trends prior to the actual default event. The average total decline in domestic GDP during the three years prior to domestic debt defaults is 8%, compared to an average decline of 1.2% for external defaults.¹¹

Banking crises, another frequent driver of systemic events, may be defined as either the failure, takeover, or forced merger of one of the largest banks in each nation or, absent such corporate events, a large-scale government bailout of a group of large banks in that nation. Using this definition, there have been a tremendous number of banking crises that have occurred globally throughout history. Dating back to the year 1800, 136 countries have experienced some form of banking crisis.¹²

An important point to note is that banking crises have historically been intertwined with other categories of financial crises. For example, many banking crises have been fueled, at least in part, by the bursting of asset bubbles in real estate and national stock markets. However, many of these same bubbles were enabled by the banking sector itself as banks are often the main provider of credit and liquidity for real estate financing. This point is supported by the following statement:

*Interconnections among financial firms can also lead to systemic risk under crisis conditions. Financial institutions are interconnected in a variety of networks in bilateral and multilateral relationships and contracts, as well as through markets.*¹³

Arguably the most important and practical benefit of studying the common drivers and details associated with previous systemic events is to learn from the past and the potential for using facts and statistics related to such events to help identify the buildup of emerging systemic threats.

WHY SYSTEMIC RISK MUST BE UNDERSTOOD, MONITORED, AND MANAGED

As previously mentioned, systemic events have been occurring for centuries and with devastating impact. Using events such as the Great Depression and the Credit Crisis as just two examples, both events led to the failure of

hundreds of banks and other financial institutions in the United States and globally, deep and long-lasting global recessions, the seizing up of global credit markets, the need for massive government bailouts, and a tremendous loss of jobs in the private sector that in turn led to significant spikes in personal bankruptcies.

As we cover in more detail later in this book, there have been a multitude of causes for such events, many of which are extremely complex for several reasons. For example, what differentiates systemic risks from the more traditional forms of risk is that the former are typically classified by their impacts as opposed to their causes. Systemic risks can arise in many forms, can develop rapidly, and can be unpredictable. Another major difference is that systemic risk can involve interconnectedness of markets and industry participants, rather than a single, discrete source of risk. By its nature, systemic risk is also an extremely broad topic, subject to many different definitions, sources, and impacts. One of the reasons that systemic risk analysis has not yet evolved into a standard component of risk management practices in the financial industry is the lack of a roadmap that summarizes these many components and available tools to help support repeatable identification and monitoring processes.

Because of these significant challenges, and in consideration of the devastating effect systemic events have been shown to have on global economies, it is imperative that such risks become better understood and monitored so there is a greater likelihood they can be detected early to protect global financial institutions, the stability of financial markets, and individual taxpayers.

If history is any indicator, it is unlikely that all or even many future systemic events can be predicted ahead of time. That said, given the significant amount of data and other facts available concerning the root causes of the Credit Crisis and other financial events, this information has proven to be very helpful in the creation of models and other tools that may serve as early warning indicators in the future. In addition, as covered in detail in the second half of this book, new financial regulations have been enacted in the United States and internationally at a rate not seen since the Great Depression. Multiple new regulatory bodies and agencies have been created globally to oversee and enforce these new rules, most of which are aimed at the banking industry. In addition, financial institutions have vastly expanded their focus on systemic risk identification and mitigation.

While this clearly heightened global focus on systemic risk is certainly encouraging, the analysis and quantification of systemic risk remains a relatively nascent area. There is still a need for new and enhanced tools to assist the industry in its efforts to better understand, quantify, monitor, and