VOLUME I

PRINCIPLES AND CONTEXT

PART I

RISK MANAGEMENT CONTEXT FOR FINANCIAL DATA

EDITORS' INTRODUCTION TO PART I

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The events of 2007–2009 should have dispelled any doubts about the importance of data and information for the management of risks in the financial system. The litany of information problems is by now painfully familiar: banks too big and too interconnected to fail, structured securitizations too complex to evaluate, shadow banking, inaccurate third-party credit ratings, mis-specified value-at-risk models and six-standard-deviation surprises, robo-signing of legal documents, and on and on.

The consequences of bad information can be enormous. Yet the underlying management issues here would be important even in the absence of a crisis. Many of these challenges are not a one-time fluke, but a basic characteristic of the Information Age. As data proliferate in financial markets and elsewhere, the need to manage those data becomes more urgent. Overall, data volumes are expanding at an exponential rate. Those organizations that successfully tame and harness this data flow will wield a powerful tool. Organizations that fail at this risk being overwhelmed – drowning in data and overmatched by better informed competitors.

The opening section of the *Handbook of Financial Data and Risk Information* provides a big picture view of the institutional and organizational context within which financial data and risk management occurs. Much of this activity occurs at the level of the individual firm, and a vast body of technical expertise, legal and regulatory constraints, and institutional practice have accumulated to guide it. This section of the Handbook examines the historical legacy that brought us to this point as well as the state of the art of risk management, reporting, and governance within financial firms. Risk and information are also issues beyond the boundaries of any one firm, however. The various tasks associated with systemic risk fall largely to regulators, with supervisory risk monitoring and policy making replacing firm-level risk management and governance as the foci. The section concludes with some reflections on the meaning and implications of the brave new data-centric world that dominates modern finance and risk management.

There are economic, intellectual, and historical reasons why we operate within the current system. Our immersion in a financial world dominated by computational infrastructure, large databases, and complicated risk systems has been sufficiently gradual that it can be difficult to imagine that it was ever otherwise. Proper understanding of the high-level forces and constraints that got us here is important for building data and information systems that work. With that in mind, Chapter 1, by Mark Flood, examines how we arrived at the current context of institutions, technologies, and risk practices, starting with the origins of risk management. The overlapping themes of institutionalization, technology, globalization, and complexity dominate this history, and emblematic technologies and events such as wars and financial crises illustrate the evolution of institutions and technologies through time and space. In the end, the more things change, the more they stay the same.

Chapter 2, by Robert Mark and Dilip Krishna, covers the landscape of risk management today and the tools used to carry out the discipline. The emphasis is on the practical realities of implementing risk systems. The authors survey the main categories of financial risks (market, credit, and liquidity) and "non-financial" risks (operational, strategic, reputational, and business). Risk systems are an enabling technology that has supported and encouraged many of the recent innovations in financial products, markets, and regulation in recent years.

Risk modeling, however, is of limited use if the information and insights derived from risk systems are unavailable to decision makers. In Chapter 3, Cliff Rossi looks at risk governance and reporting structures, especially the presentation of risk information to the board of directors and senior management. The running example in this chapter is a mortgage portfolio with its attendant assets, liabilities, business lines, and risk types, but the lessons for risk monitoring generalize to any financial firm. Key principles for effective risk monitoring are that it should be transparent, operationally tractable, forward-looking, integrated, and action-oriented. Building risk systems to achieve these goals requires a clear commitment from the leadership of the organization.

The challenges faced within the firm are only part of the landscape. Individual financial firms may have the tools and skills for managing their specific business risks, but this alone is insufficient. The financial crisis was a sharp reminder of the importance of monitoring and managing risks across the financial system as a whole. Data collection and analysis for systemic risk are the subject of Chapter 4, by Alan King, John Liechty, Cliff Rossi and Charles Taylor. Because systemic risk, by definition, breaches the boundaries of individual firms, the task of monitoring these risks falls to the regulatory community. The authors examine the definition(s) of "systemic risk" and highlight the various policy options available for monitoring and addressing it. We are still just beginning a long journey to explore the implications.

In Chapter 5, John Pattison reviews regulators' increasing reliance on formulas and models in the years leading up to the financial crisis. *Data-driven regulation* means that the information set guiding official supervision is guided and dominated by formal collections of well-defined, primarily numeric data. Alongside the obvious operational efficiencies, this also introduces layers of abstraction and quantification that have the potential to distract supervisors' attention from the underlying financial reality. Pattison argues that data-driven regulation has permanently changed the relationships under which supervision occurs, with important conversations mediated by data and analysis constrained by formal models. The net result is a relative shift in power to an expert caste of regulators with the technical skills to use the new tools.

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A brief history of financial risk and information

Mark D. Flood

This chapter presents the historical context for the current state of financial information and risk management. At any point in time, the institutions and practices that constrain financial behavior are just the latest point in an evolutionary process along a single historical path. Our basic understanding of events is subject to this path dependence too. Keynes (1936, p. 383) notes that, "Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist." In tracing events over the longer term, the rhymes of history begin to emerge. There are recurring dynamics and episodic patterns that make history something more than mere chronology. Reinhart and Rogoff (2009), for example, mock the perennial speculator's incantation that "this time is different" with a sobering litany of financial over-enthusiasms that have ended in tears.

On the other hand, the world has indeed changed over the long run. As we write this, the global financial system is still emerging from the catastrophic events of 2007–2009. While one of this chapter's central goals is to demonstrate that many of the features of the recent crisis have historical antecedents, events that may appear to be defining characteristics of the latest trauma – such as interconnectedness, technological sophistication, and world-wide impact – are in fact the manifestations of broader historical trends that have been at work for decades or centuries. This is clearly true of the four thematic dimensions I emphasize below: institutionalization, globalization, technology, and complexity.

It is impossible to do justice to this rich history in such a brief space. Indeed, entire books have been written on subsets of the topic.[1] In lieu of a comprehensive history, the discussion ranges widely here, illustrating the broad historical themes by

[1] Examples include Goetzmann and Rouwenhorst's (2005) compendium on the history of financial innovation, Bernstein's (1998) history of the intellectual enterprise of modeling risk, Gleick's (2011) history of information theory, or the one-volume histories of various aspects of economic and financial development in the Atlantic sphere, by Kindleberger (1993), Neal (1990), Ferguson (2008), Grossman (2010), or O'Rourke and Williamson (2001).

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identifying emblematic events while providing pointers to additional resources for deeper research on specific topics. I compensate for space constraints by decorating the discussion with recommendations for further reading. This makes for a lengthy bibliography, which the reader will hopefully find useful.

1.1 The institutionalization of financial services and regulation

History documents the gradual and piecemeal institutionalization of financial markets. Starting with the Age of Exploration, new organizations begin to emerge that are still familiar today. Developing and maintaining supply routes that extended to the Far East and the Americas required more capital and greater degrees of coordination than before. Hence, we see the introduction of new forms of ownership and control, such as the limited liability corporation, exemplified by the Dutch East India and British East India companies, described below. In turn, these new firms required access to deeper capital pools to fund their infrastructure; hence the creation of stock exchanges in London and Amsterdam. Also important were enhancements in risk management to spread the losses due to maritime hazards; hence Lloyd's of London, also described below.

The institutionalization of commerce is mirrored by institutionalization of the accompanying supervisory and regulatory superstructure.[2] As noted, there is a powerful historical path dependence that describes our current institutional status quo. Institutional change typically accretes gradually, limited by legal and bureaucratic inertia and frequently in concert with technological advances. Major events occasionally disrupt this process. Calomiris and Gorton (1991) note that the history of financial regulation can be written as a chronology of traumatic events, linking each to the financial institutions created in its wake. Table 1.1 provides a few examples. Even this brief sampling should firmly establish the "crisis mechanism" as a means of generating new institutions. The most recent such examples in the USA are the Financial Stability Oversight Council (FSOC) and Office of Financial Research (OFR), created through the Dodd–Frank Act, and which stand as memorials to the market collapse of 2008. Whether created in reaction to a crisis or to serve another financial purpose, such institutions tend to have remarkable staying power. A few, such as the First and Second Banks of the United States, have been dissolved, but many others, such as the Federal Reserve (1913) or the US National Banking System (1863) are still with us long after the memories of the Panic of 1907 or Civil War financing have

[2] A more detailed chronology of the establishment of US regulatory institutions appears in Chapter 12. A discussion of the current evolution of regulatory institutions in the European Union is found in Chapter 13. The crisis of 2007 and its aftermath is discussed in Chapter 5.

Table 1.1 *Some crises and their institutions*

Crisis	Institution(s) created	Reference
US Civil War (1861–1865)	National Banking System and Comptroller of the Currency	Hammond (1991)
Panic of 1907	Federal Reserve	Johnson (2010)
Great Depression (1930s)	Federal Deposit Insurance Corporation (FDIC)	Flood (1992)
	Securities and Exchange Commission (SEC)	Seligman (2003)
	Federal Housing Administration (FHA), Federal National Mortgage Association (Fannie Mae), and Federal Home Loan Bank system	Wheelock (2008)
	Bank of Canada	Bordo and Redish (1987)
Paperwork Crisis (late 1960s)	Securities Investor Protection Corporation (SIPC)	Markham (2002b)
Bank Herstatt failure (1974)	Basel Committee for Banking Supervision (BCBS)	Goodhart (2011)
Savings and Loan Crisis (1980s)	Office of Thrift Supervision (OTS), and Federal Housing Finance Board (FHFB)	FDIC (1997)
Global Financial Crisis (2007–2009)	Office of Financial Research (OFR), Financial Stability Oversight Council (FSOC), Federal Insurance Office (FIO), and Consumer Financial Protection Bureau (CFPB)	FCIC (2011)
	Financial Policy Committee (proposed) of the Bank of England	BoE/FSA (2011)
	European Systemic Risk Board (ESRB)	Nymand (Chapter 14, this Handbook)

faded.[3] The result, at any point in time, is a patchwork of official institutions, each originated in response to a specific historical event or need.

A second theme that appears repeatedly over time is financial innovation as a response to the inflexibility of official institutions. Kane (1977) posits a "regulatory dialectic" of alternating innovations and countermanding rules succeeding each other over time. For example, the three estates of church, nobility, and commoners dominated the institutional structure in Europe throughout the Middle Ages and up to the Industrial Revolution. In finance, an important practical issue was the need to accommodate the Church's ban on usury, taken from Deuteronomy (23:19–20).

[3] Bruner and Carr (2007) provide a readable and informative account of the Panic of 1907. See Johnson (2010), Friedman and Schwartz (1971), and Markham (2002b) on the founding of the Federal Reserve. Regarding the Bank of the United States and the National Bank Act, see Hammond (1991) or Markham (2002a).

The ban was vigorously debated and enforced for centuries, and it hampered a wide range of economic activity, most notably the financing of military adventures. One workaround was to delegate the business of money lending to Jews, who by definition were not subject to excommunication. The economic segregation of money lending facilitated economic activity, but unfortunately tended to reinforce anti-Semitic attitudes by adding a profit motive for the recurring pogroms that plagued the Jewish community.[4] Munro (2003) documents a number of more intricate circumventions of the rule, many of them variants of perpetual annuities, known as *rentes*, that sufficiently disguised the accrual of interest. These innovations expanded the range of financial techniques, forming a foundation for a subsequent "financial revolution."[5]

Few endeavors are riskier than war, and historically much of finance was devoted to funding the imperial exploits of the European powers in their high-stakes games. The voyage of Columbus was a precursor to several centuries of conquest and settlement, with the potential for violent conflict with indigenous locals or open warfare with national rivals. Large-scale conflict is a speculative undertaking for both the participants and their financiers. Historians sometimes refer to the "fiscal-military state" to describe militaristic societies where much of economic life exists in the service of financing a large standing army and navy (see Knights, 2012). The European powers in the fifteenth to eighteenth centuries fit this description. Frederick the Great, who had to feed a famously effective standing army, advised, "A financial system, handed over by father to son and constantly improved, can change a government's position" (Scott, 2009, p. 23). It was especially in Britain, however, that the needs of military funding supported the development of financial markets. In contrast to absolutist monarchies, which might renege on their debts, the invigorated powers of the British Parliament after the Glorious Revolution of 1688 created a public counterweight that could hold the crown to task for the repayment of debts (North and Weingast, 1989). This credible threat brought lenders into the market, making large-scale public borrowing possible and spurring the development of private financial markets as well.

The stakes for fiscal-military states were indeed high: the arrival of bullion (primarily silver) from Spain's New World colonies was a major contributor to the so-called "price revolution" in Europe, a two-century inflationary episode driven largely by mining discoveries and processing advances (see Braudel and Spooner,

[4] Usury was the subject of a number of ecclesiastical rulings over the centuries, of which the Third Lateran Council in 1179 is one of the more significant. Homer and Sylla (1986) provide a useful and concise chronology (although they appear to neglect Lateran III). Modern Christian teaching has largely relaxed prohibitions on usury. It remains an important feature of Islamic finance: El-Gamal (2008) describes the Shari'a prohibitions on usury (*riba*) and gambling (*gharar*), as well as techniques and ramifications of Shari'a arbitrage. Most US states still impose an explicit legal usury ceiling on interest rates; the cap varies by jurisdiction.

[5] On *rentes*, see also Kindleberger (1993, ch. 12–14). The term "financial revolution" refers to a nexus of activities, with a large increase in public borrowing being a notable characteristic. The financial revolution occurred at different times in different places. See, for example, Tracy (1985) and Wennerlind (2011).

1967). Naturally, the producer of the precious metals was the immediate beneficiary of this increase in purchasing power, at least when it escaped the grasp of Dutch and English pirates. Spain ultimately dissipated most of this windfall on the European wars of the Counter-Reformation (the defeat of the Spanish Armada in 1588 is the most famous example) or squandered it on royal extravagances like the Buen Retiro palace in Madrid. Reinhart and Rogoff (2009) note that Spain was a "serial defaulter" on its sovereign debt during the reigns of Philip II and his successors (roughly 1550 to 1650).

After the political revolutions of the eighteenth century, the fiscal-military states gradually reoriented themselves. Industrialization created less painful and less risky paths to enrichment for the ambitious and enterprising. Not coincidentally, the Industrial Revolution, with its focus on capital-intensive industries, coincided with the formalization of markets for equity shares: the London Stock Exchange was formally organized in 1773, while the Buttonwood Agreement creating the New York Stock Exchange (NYSE) was signed in 1792.[6] It is in the relatively peaceful nineteenth century that the institutionalization of financial markets becomes pervasive.

The relatively peaceful nineteenth century was eventful in other ways. The Panic of 1825 in London saw the first experiments with a lender of last resort (a cornerstone of central banking), which led to a gradual restructuring of the British financial system.[7] In that episode, the Bank of England, then a shareholder-owned public bank without lender-of-last-resort responsibilities, stepped into the breach of a major liquidity crisis. By lending to other banks at a discount (against good collateral), they enabled institutions to satisfy withdrawals, thus stemming the panic. Posting collateral in a crisis to liquidate assets without selling them, addresses what is at root an information problem, namely the inability of creditors to observe directly the quality of the debtor firm's assets. The lesson learned by central bankers from the 1825 experience has become known as Bagehot's Rule: lend freely in a crisis, on the basis of any acceptable collateral ("any good banking securities"), but at a "very high rate of interest" (see Bagehot, 1873, p. 197). The USA would suffer nearly a century of similar clearing crises before founding the Federal Reserve in 1914. Unfortunately, while the existence of a central bank should facilitate crisis response, it does not guarantee good monetary policy, a point driven home after the 1929 crisis.[8]

[6] See Neal (1990) on the creation and expansion of exchanges in Europe and elsewhere. Sylla (2005) focuses on the founding of the NYSE. The Amsterdam Stock Exchange is an exception that proves the rule – it was founded in 1602 to support trading in shares of the Dutch East India Company.
[7] See Bagehot (1873), Neal (1998), and Bordo (1998).
[8] On the 1929 crisis and Federal Reserve response, see Friedman and Schwartz (1971), Galbraith (1955), and Ahamed (2009). There are more extreme examples as well, including the German hyperinflation of 1922–1923; see Kindleberger (1993, ch. 17) and Eichengreen (1992, ch. 5).