Law & Social Inquiry
Volume 00, Issue 00, 1–42, 2024

Don't Call It a Failure: Systemic Risk Governance for Complex Financial Systems

Giuliano G. Castellano

The probability that an event will avalanche into an impairment of essential services constitutes a "systemic risk." Owing to the inherent complexities of modern societies, the outbreak of a novel disease or the failure of a financial institution can rapidly escalate into an impact significantly larger than the initial event. Through the lens of complex system theory, this article draws a parallel between financial crises and disasters to contend that the regulatory framework for financial systemic risk is unequipped to address its fundamental dynamics. Epitomized by the market failure rationale, financial regulation is premised on a reductionist view that purports both systemic risk and law as external to the actions of market participants. Conversely, this article advances a twofold conceptual framework. First, it shows that systemic risk emerges from the same complex dynamics that generate the financial system. Second, it understands law as an agent of complexity, thus contributing to the emergence of finance and its inherent instability. Normatively, this conceptual framework reveals the limits of current regulatory approaches and constructs a holistic risk governance framework that is akin to the one adopted to govern disaster risks.

INTRODUCTION

As an integral component of everyday life, risk permeates the social fabric. Different social, political, and legal institutions are established to limit the probability and contain the possible impact of adverse events associated with common activities, such as crossing the road or depositing money in a bank account. Some risks, however, pose larger and more fundamental threats than others. Specifically, the possibility that an event will cascade into a series of consequences leading to the failure of services essential to societies constitutes a systemic risk (Organisation for Economic Co-operation and Development 2003, 3). These risks are inherent to modern societies (Giddens 1990; Beck 1999). However, owing to their complex nature and widespread impact, they are often misperceived and cannot be managed with the same methods adopted for more common risks. As societies are bracing for systemic risks connected to climate change, geopolitical tensions, and economic imbalances, understanding these

Giuliano G. Castellano Associate Professor of Law and Deputy Director, Asian Institute of International Financial Law, Faculty of Law, University of Hong Kong, Hong Kong, Special Administrative Region of the People's Republic of China g.castellano@hku.hk

I am indebted to four anonymous reviewers whose detailed and constructive reviews have been beyond helpful. Moreover, I am extremely thankful to Douglas W. Arner, Benjamin Chen, Elizabeth Fisher, Hualing Fu, Sangita Gazi, John Murphy, Zhuang Liu, Silvia Pezzini, Alec Stone Sweet, and Ryan Whalen for their insightful comments and inspiring discussions during various stages of this work. All errors remain my own. The research underlying this work was conducted while I was a visiting scholar at Columbia Law School, for which I must thank Katharina Pistor.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

phenomena is a necessity that transcends disciplinary and policy boundaries. Nevertheless, a stark conceptual and normative divide emerges between financial systemic risk, resulting in financial crises, and non-financial systemic risk, leading to disasters. While the intensification of catastrophic occurrences has prompted policy makers to devise a holistic disaster risk governance framework, financial regulation remains severed from this general trend. Hence, the maintenance of financial stability relies on a composite set of regulatory regimes that are chiefly enacted after each crisis and built on an understanding of systemic risk exclusive to finance. Yet the reoccurrence of crises raises fundamental questions on the effectiveness of this approach and its underlying assumptions.

Drawing a parallel with non-financial systemic risk, this article argues that financial regulation is unequipped to grasp the complex dynamics that give rise to financial systemic risk, and new conceptual premises are needed to promote financial stability. Non-financial systemic risks are commonly considered complex, emergent, and recurring phenomena. They are complex because they stem from multiple causes and feedback loops, generating an impact larger than the initial event (Renn 2008, 186). They are emergent and recurring because they are connected to social dynamics; as interdependencies between social actors grow, the frequency and impact of disasters increase.[1] Accordingly, disaster risk reduction sets out a holistic governance approach for any hazard enshrined in the Sendai Framework and is designed to address vulnerabilities and increase the preparedness of affected communities, thus ensuring adaptation.[2] Conversely, the legal understanding of financial systemic risk is anchored in the notion of market failure.[3] Put differently, financial systemic risk is construed as a deviation from a natural state of equilibrium.[4] According to this view, legal and regulatory norms are deemed to perform a corrective function by addressing the causes

1. The figures gauging the impact of disasters are astonishing; for instance, in 2023, global disasters resulted in $250 billion losses and seventy-four thousand fatalities, well above the thirty-year average of $180 billion losses and forty thousand disaster-related deaths (1993–2022) (Munich Re 2024). The increased frequency and impact of disasters is attributed to different social dynamics, such as the growing interconnectedness of people and societies resulting from the process of globalization, as well as anthropogenic factors, including deforestation, urbanization, industrialization, and, more broadly, human-induced climate change (Organisation for Economic Co-operation and Development 2003; Goldin and Mariathasan 2014).

2. Following consultations and intergovernmental negotiations facilitated by the United Nations Office for Disaster Risk Reduction on March 18, 2015, the Third United Nations World Conference on Disaster Risk Reduction, held in Sendai, Miyagi, Japan, adopted the Sendai Framework for Disaster Risk Reduction 2015–2030, UN Doc A/CONF.224/CRP.1, 2015 (Sendai Framework). The Sendai Framework aims to reduce the likelihood and impact of disasters arising from natural and anthropogenic hazards, including those related to biological, environmental, geological, hydrometeorological, and technological processes or phenomena. To this end, it sets seven targets and four priorities that the international community should reach by 2030 "through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures." See Sendai Framework, para. 7.

3. In scholarly and policy circles alike, albeit with different degrees of precision, the market failures rationale is often used to both define financial systemic risk and justify ensuing regulatory intervention (Armour et al. 2016, 57; International Monetary Fund, Bank for International Settlements, and Financial Stability Board 2016, 4; Moloney 2012, 436; 2023, 4; Schwarcz 2008, 206).

4. In economics, market failure refers to a situation in which the allocation of resources in a free market is suboptimal (Bator 1958); it departs from the optimal status of equilibrium that competitive market forces are expected to attain (Arrow and Debreu 1954).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

of such anomalies to ensure that markets can reach their optimum. Hence, rather than adopting a system-wide perspective, financial regulation promotes financial stability through a scattered body of rules focused on specific facets and events that may threaten the functioning of the financial system (Schwarcz 2008, 2019).

To develop the main argument, this article sets forth a twofold conceptual framework unveiling the relationship between system-wide disruptions, social systems, and law. First, it posits that any systemic risk is inherent to the dynamics of the social system it threatens. A system is considered complex when it emerges from interactions between its components that escape linear (cause-and-effect) relationships (Cilliers 1998, 3–4; Sawyer 2005, 3).[5] Although complex social systems are generally robust as they adapt and evolve over time (Bertalanffy 1950; Parsons 1951, 6; Kauffman 1993, 29), they are not characterized by a single state of equilibrium (Bailey 1994; Luhmann 1995; Parisi 2023). Oscillating between chaos and order, nonlinearities within complex systems can generate system-wide disruptions spontaneously or through interactions with the environment. As exemplified by the novel coronavirus disease (COVID-19), new infections can emerge and escalate into a global health crisis due to demographic trends and urbanization (Wolfe, Dunavan, and Diamond 2007), the frequency of international travel, socioeconomic inequalities (Farmer 2001; World Health Organization 2017, 29), and uncoordinated governance responses across jurisdictions (Alemanno 2020).

The second prong of the conceptual framework considers law as an agent of complexity, inextricably interwoven with the nonlinearities of the social systems it regulates. As a self-organized structure (Teubner 1988; Luhmann 2014), law shapes, and is shaped by, the decisions of individuals (Edelman, Uggen, and Erlanger 1999). The recursive interactions between law and social actors result in complex dynamics that transcend a simple compliance or non-compliance dichotomy. Influenced by cultural, political, and psychological factors (Douglas and Wildavsky 1983; Vogel 2012; Thaler and Sunstein 2021), social actors respond and adapt to rules in a strategic manner (Baldwin and Black 2008). These interactions, in turn, generate new (or amplifying existing) nonlinearities that may result in severe consequences. For instance, regulatory regimes may disincentivize individuals and organizations to implement preventative measures, overlook small risks, or misinterpret unfolding emergencies (Black 2014). Hence, law relates to systemic risks in an ambivalent manner: on the one hand, it supports the emergence of complex social systems; on the other hand, it may trigger unexpected outcomes, contributing to system-wide disruptions.

Applied to finance, this conceptual framework challenges dominant assumptions underscoring financial regulation. Crucially, it indicates that the institutionalization of financial systemic risk, premised on the notion of market failures, is incompatible with

5. Complex system theory draws contributions from different fields, such as physics, social sciences, mathematics, and biology, to study the dynamics that (at different scales) lead multiple components to generate a larger, self-organized whole (Thurner, Hanel, and Klimek 2018). Breakthroughs in this multidisciplinary area have led to a more accurate understanding of our reality. Most recently, the Nobel Prize in Physics 2021 was jointly awarded to Syukuro Manabe and Klaus Hasselmann for their contributions to understanding the earth's climate and global warming and to Giorgio Parisi "for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales." See Royal Swedish Academy of Sciences 2021.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

the idea that finance is a complex social system. This view, in turn, contributes to current scholarly and policy debates in various ways. It expands on studies concerned with the relationship between complexity and financial instability,[6] as financial systemic risk is considered always endogenous because it stems from the nonlinear interactions between market participants. Moreover, building upon the notion that finance is legally constructed,[7] it shows that law contributes to the complexity and, thus, to the instability of the financial system. Finally, it offers a richer understanding of the relationship between financial crises and regulatory responses.[8] Evidence from the 2007–8 global financial crisis (GFC) and the 2023 banking crisis is offered to demonstrate that policies aimed at easing or tightening regulatory pressure may have an equally detrimental impact when they neglect complex, system-wide dynamics. Echoing the shortcomings noted in the aftermath of the GFC, the failure of Silicon Valley Bank (SVB) and the demise of Credit Suisse (CS) have been ultimately connected to the complexities created by both deregulatory policies (Federal Reserve 2023, 6) and stringent regulatory requirements (Swiss National Bank 2023, 26).

Normatively, the conceptual framework advanced in this article offers a bedrock to develop a different approach to financial systemic risk. Challenging solutions that attempt to neglect or reduce nonlinearities in finance, a governance framework that acknowledges and engages with the socio-legal complexities underlying finance is proposed. Based on the international structure developed to deal with disaster risks, the proposed approach institutionalizes the notion that systemic disturbances are inherent to finance and follow a cyclical pattern. Regulatory regimes, thus, are calibrated to meet prevention, preparedness, emergency response, and recovery priorities; responsibilities to reduce the probability and limit the impact of a crisis are allocated *ex ante* through a whole-of-society approach, while the actions of different social actors are coordinated through structured communication policies. Juxtaposed to international standards and regulatory regimes currently deployed in the United States and Europe, this new governance framework is offered to demonstrate that different understandings of financial systemic risk result in radically different solutions.

FROM CHAOS TO COSMOS: THE EMERGENCE OF COMPLEX SOCIAL SYSTEMS

Systemic risks cannot be prescinded from the systems they threaten; indeed, a system-wide disruption cannot occur without a system to disrupt. Yet the dynamics that transform an event (or a combination of events) into a systemic failure are far less obvious and require an investigation of the nature of social systems. After eliciting the

6. A multidisciplinary literature convincingly expounded the relationship between complexity within firms and markets and financial instability (Cunningham 1993; Schwarcz 2009; Haldane and May 2011; Utset 2011; Roe and Troge 2018; Awrey and Judge 2020).

7. Influential legal scholarship contended that law is external to market dynamics, indicating that economic decisions, financial transactions, and markets movements are shaped by and shape legal rules (Riles 2011; Pistor 2013; Black 2013).

8. It is often noted that financial regulation is crisis driven and that periods of regulatory tightening, in the aftermath of a crisis, are followed by period regulatory easing owing to the swing of political pressure (Snider 2011; Coffee 2012).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

core characteristics of complex social systems, this section of the article indicates that finance is a complex social system and shows that law—comprising a heterogenous body of private law rules and regulatory regimes—is a source of new nonlinearities contributing to the emergence of the financial system.

Complex Social Systems: A Primer

Philosophers, sociologists, and economists have long observed how a seemingly chaotic web of social interactions among individuals, institutions, and their environment coalesces into an order (Sawyer 2005). Moreover, studies on the genesis and evolution of living organisms (Varela, Maturana, and Uribe 1974) have shed new light on how social institutions and organized social systems come into existence (Teubner 1988; Luhmann 1995; Capra 1997). Similarly, compelling economic research equates finance with natural ecosystems (Haldane and May 2011; Arthur 2015, 151). The common denominator of these studies is that social systems of different scales—ranging from small communities to sophisticated economies—stem from complexity. Like natural systems, such as a cell or the biosphere, they display a series of common properties. Specifically, three general features define any complex social system and are particularly relevant to this analysis. First, complex must not be confused with complicated. A system is complicated when its features can be inferred by examining its components. Complicated systems—like computers, nuclear power plants, or even financial transactions—are governed by linear dynamics, whereby each input corresponds to a proportional output (Cilliers 1998, 3). Differently, when the dynamics within a system give rise to larger patterns that do not respond to direct cause-and-effect relationships, the system is complex (Kauffman 1993, 29). This property, also observed in living organisms, is referred to as "nonlinearity" and indicates that outputs are not proportional to the corresponding inputs (Cilliers 1998, 5–7). For instance, small changes in the genome of a pathogen or its environment can lead an isolated outbreak to become a large-scale epidemic (Kucharski 2020, 23–26). Nonlinear dynamics can also generate positive feedback loops; as further examined below, high investment returns stem from small actions that are amplified through iterations between market participants.

In essence, nonlinearity explains why complex social systems entail unexpected outcomes. Due to multiple causal links, recursive exchanges, and feedback loops interrupting the linear sequence of events, changing one part of a complex system (input) might result in an exponential change in the other part (output) at a different time. Perhaps the most iconic metaphor to explain nonlinearity is the one offered by Edward Lorenz (1963) and termed the "butterfly effect."[9] Lorenz observed that the formation of a hurricane might depend on whether a butterfly located on a distant part of the globe had flapped its wings weeks earlier. In more prosaic terms, this property is known as "sensitivity to initial conditions" and was first noted in the nineteenth century by French mathematician and engineer Henri Poincaré to indicate that a minor cause in a complex physical system determines a much larger effect.[10]

9. The locution "butterfly effect" was coined by Phil Merilees as the title of Edward Lorenz's speeches (quoted in Palmer 2009, 145–46).

10. Henri Poincaré's contribution has influenced the development of complex and chaos theory (Barrow-Green 1997).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Second, complex social systems are not transient phenomena. In the natural and social world alike, through reiterated interactions, no matter how small, different elements generate a self-organized whole. This property is referred to as "emergence" and indicates that the nonlinear dynamics among various components spontaneously result in a new organizational structure: a system. Many small interactions between individuals produce larger patterns that ultimately result in a social system (Sawyer 2005, 5), similar to a V-shaped flock of birds where each bird sets its course based on the relative position of nearby birds rather than lining up to follow a leader. The result is not merely a material structure but also a network of relationships in which individuals' competitive and cooperative behaviors give rise to a unity that performs one or more functions.

This feature is ubiquitous in social contexts. Deepening its roots in Aristotle's (1989, Book 8, 1045a) notion that a whole requires more than its components to create unity, social emergence became the fulcrum of theories developed by French sociologists Auguste Comte and Émile Durkheim to connect individual actions to a larger spontaneous order. Based on these insights, social systems have been explained as deterministic rather than random since any change in the current state influences its future shape and helps perpetuate its existence over time. In other words, borrowing from the concept of path dependence developed in the social sciences, it can be said that "history matters" (North 1990; Urry 2005, 239). Complex systems adapt and evolve, and their past influences their present behavior (Cilliers 1998, 90).

Third and consequentially, the behavior of a complex system is irreducible; it cannot be inferred from the behavior of its constituent parts. As Comte (1875, 153) argued, "[a] society ... can no more be decomposed into individuals than a geometric surface can be resolved into lines or a line into points." Therefore, to understand the dynamics of a complex system, the focus must be shifted from its components to the whole. Specifically, unlike complicated systems that are studied by segmenting their structure into smaller parts to isolate different (linear) relationships, a complex system is primarily examined through functional analyses focusing on the activities performed by the system and their evolution.

Financial Complexities

The financial system displays complex properties. Comprised of various activities—most notably, banking, investment, and insurance sectors—finance is characterized by the co-existence of heterogeneous groups of social actors, including public entities, private firms, platforms, investors, and retail customers. The recursive (competitive or cooperative) interactions between different actors give rise to a self-organized structure of relationships that performs the critical societal function of deploying and transferring economic resources between social actors over time (Merton and Bodie 1995). In short, complexity explains why the aggregate actions of individuals, each animated by self-interest, result in market trends operating as an "invisible hand," to borrow from Adam Smith's (1902, 160) famous metaphor.

Nonlinearity describes fundamental financial processes. Through financial leverage, for instance, market participants can gain (or lose) exponentially from their initial investment, be it a mortgaged house, college savings, or a stake in a publicly listed

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

company. Through maturity and liquidity transformation performed by banks, short-term liabilities (deposits) are converted into long-term assets (loans), supporting the real economy and, thus, inducing the creation of new deposits and loans. Through financial intermediation, an ever-expanding network of interdependent relationships connects different social actors, ranging from depositors and borrowers to corporations and governments seeking funds. Compared to other complex systems, however, finance presents additional elements of complexity, reflected in the strategic actions of economic agents fueling a constant process of self-innovation.

Market participants engage in strategic behaviors. Firms, customers, and investors are cognitive agents. Their choices are based on changes in the external world and on expectations regarding the consequences of their actions (Arthur 2015, 107). Empirical studies on price formation in capital markets corroborate this point. The efficient capital market hypothesis, a pillar of neoclassical economics, posits that individuals participate in market transactions with fully formed preferences.[11] Since the hypothesis implies that investors are rational and unbiased, any price movement should reflect a reaction to choices taken on the information previously available. However, financial economist Robert Shiller (2008, 47) demonstrated that traders disregard independently collected information and act instead on general information and investment strategies followed by others, resulting in herd-like dynamics. Informational cascades and feedback loops influence movements in stock prices that, in turn, spur an increment in trading activities, prompting further changes in prices and volatility (Shiller 1989, 374; 2008, 45–46).

Nonlinear interactions between market participants are amplified by a process of innovation, whereby the financial system evolves and expands its reach. Generally identified as both a propelling force of capitalism and a source of disruption (Schumpeter 1947, 132), innovation reflects the adaptive nature of economic systems engaged in a process of continuous self-destruction and reconstruction (Arthur 2015, 3). Through technological advancements, transactional structures, and business processes, financial institutions develop new techniques and products to reduce costs, generate revenues, and manage risks (Avgouleas 2015). Securitization, for instance, is a form of financial innovation that pools various types of assets to repackage them into different categories (or "tranches") of interest-bearing financial instruments. Accordingly, a bank can transform illiquid long-term assets—such as loans, mortgages, or credit card debts—into liquid assets sold to various investors, including public institutions and pension funds. While freeing new capital and incentivizing banks to lend more, this technique heightens the interconnectedness among financial institutions and blurs the distinction between investment and banking activities (Snider 2011, 126; Davis and Kim 2015, 208). Financial innovation also fuels profound socioeconomic changes, epitomized by the process of financialization (Krippner 2005; Van der Zwan 2014). Structured financial products have been fueling the growing reliance on finance as a source of economic growth, connecting social actors who are traditionally distant, such as households and

11. The efficient capital market hypothesis, elaborated by Eugene Fama (1965, 1970), has been refined over time and comprises different variants—namely, the hypotheses that share prices reflect all information (strong variant), the only information available (semi-strong), or simply the information provided by historical performances (weak variant).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

fund managers. The innovations brought by integrating financial activities with digital technologies has further amplified this process.

The digitalization of financial transactions and activities has been changing the relationships between social actors, resulting in new complexities. Starting with the dematerialization of financial instruments in the 1990s, digital finance has become a bedrock of the current financial inclusion policies (Arner, Castellano, and Selga 2023; Castellano, Arner, and Selga 2023). Yet the possibility for individuals to place their orders with a tap on the phone has replaced the interpersonal component of financial intermediation, also resulting in the "gamification" of finance with coordinated herd behaviors, as evidenced by the "meme stock" hype of 2021 (Tierney 2022) and by the banking crises of 2023, which are discussed in more detail below. At the wholesale level, high-frequency trading exploits price oscillations through algorithms that execute large and automated transactions at the "speed of light" across multiple markets (MacKenzie 2023). Recursive interactions between machines, while supporting the expansion of the financial system, exacerbate market movements by adding new liquidity when markets grow and reducing it during economic downturns (Lin 2013, 698).

Collectively, these dynamics explain why finance is not in a natural status of stability. The general equilibrium theory, a mainstay of neoclassical economics, posits that free and competitive markets—with perfect information—have a natural tendency toward a point of optimal equilibrium because goods and services are allocated to those who value them most (Arrow and Debreu 1954; McKenzie 1959). However, complexity studies in economics, sociology, and political science have long noted that markets operate in a far-from-equilibrium status precisely because market participants constantly change their actions, reacting strategically to the system-wide dynamics they mutually create (Cilliers 1998, 122; Arthur 1999, 108; Urry 2005, 238). Put differently, instability is inextricably interwoven with complexity.

Legal Nonlinearities

Like finance, law is a complex phenomenon that exhibits nonlinearities, self-organization, and emergent properties. Gunther Teubner (1988) and Niklas Luhmann (2014, 284), most notably, have posited that the legal system is governed by *autopoiesis*, indicating that, through a self-produced logic, it perpetuates, evolves, and renews itself even if challenged by the outside.[12] The result is the emergence of a large variety of subsystems of sectoral rules, each responding to their inner, self-perpetuating logic. Narrowing the focus on finance, it is possible to note that a fragmented bundle of subject-specific rules and logical deductions governs financial relationships and institutions. These branches routinely overlap, giving rise to composite regimes, termed "commercial law intersections," that govern transactions and corporate actions (Castellano and Tosato 2021). Such intersections constitute new (narrower) systems of rules and logical deductions that enable economic actors to conduct their operations. For example, a transaction in which a bank extends a loan collateralized with the

12. These observations draw from the autopoiesis observed in biological systems (Varela, Maturana, and Uribe 1974).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

debtor's personal property gives rise to a commercial law intersection represented by the coming together of secured transactions law, contract law, and banking regulation (Castellano and Tosato 2021, 1027). As these legal intersections proliferate, law can be conceived as a complex system composed of subsystems that evolve and coalesce, creating smaller unities in fractal-like organizations.[13] This view explains the complexities within the law itself. Nonetheless, to understand the role of law within the financial system, a deeper analysis of how legal norms shape, and are shaped by, the recursive interactions of social actors is needed.

At a glance, law appears to be a social construct that cannot be parted from economic dynamics. Modern capitalism depends on rules, enforcement systems, and adjudication mechanisms that, in turn, originate from "spontaneously evolved customs" (Deakin et al. 2017, 190). Markets are premised on the validity and enforceability of legal commitments. Crucially, as noted by Katharina Pistor (2013, 317), finance is "a complex, interdependent web of contractual obligations . . . that link market participants to one another." Thus, law can be conceived as the syntax constructing and executing nonlinear interactions between market participants. Relationships within the financial system are legal relationships, and the enforceability of legal commitments is a determinant factor for economic agents to calculate expected returns and limit possible losses. However, drawing from complexity theory, law appears to be more than a mere vehicle to execute financial complexities.

Critically, this article qualifies law as an agent of complexity because its interactions with social actors within the financial system generate new and unique nonlinearities. First, market participants respond to regulatory standards in more articulated ways than a binary "comply" or "non-comply" reaction (Black 2013, 416). This is because strategic behaviors and other idiosyncratic factors, including personal values, peer pressure, and compliance costs, influence the response to regulation (Baldwin and Black 2008, 69–70) and the decisions of regulators (Castellano and Helleringer 2019). This is evident not only when firms adapt their choices to ensure compliance with rules (Gilad 2014; Krawiec 2019) but also when they enact regulatory arbitrage strategies, whereby transactions and corporate actions are structured to avoid regulatory requirements while ensuring formal compliance (Fleischer 2010, 230). Periods of regulatory tightening follow financial crises when political momentum is gained to initiate reforms and reinvigorate enforcement actions. Hence, while supervisory agencies adapt their strategies to address novel market practices,[14] rules are routinely changed. An example is offered by capital adequacy standards for internationally active banks, enshrined in the Basel Framework.[15]

13. Fractals are figures with a structure that does not simplify when magnified but repeats itself (Alligood, Sauer, and Yorke 1996, 149–50). Often associated with complexity, the organization and evolution of legal rules have been explained through fractal-like dynamics (Balkin 1986, 1990; Post and Eisen 2000).

14. As Julia Black (2013, 439) has noted, "private legal transactions are crafted to avoid regulatory rules, which are adjusted to catch the avoidance in a continual regulatory dance."

15. The Basel Framework is a consolidated version of the prudential standards elaborated by the Basel Committee on Banking Supervision, housed at the Bank for International Settlements. It includes, in particular, the latest amendments to the Basel Accords that member jurisdictions of the Basel Committee on Banking Supervision have agreed to implement and apply to their internationally active banks. See Basel Committee on Banking Supervision, "Basel Framework," 2024, https://www.bis.org/baselframework/BaselFramework.pdf (Basel Framework).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

The Basel Framework aims to ensure the soundness of individual banks and the financial system's stability. It follows a risk-weighting approach, whereby the amount of regulatory capital, consisting of the bank's "unborrowed" funds (such as shareholders' equity) varies depending on the level of risk borne by the bank each time a loan is extended (Armour et al. 2016, 290–315; Cranston et al. 2018, 27–40). In essence, as noted elsewhere, regulatory capital connects the extension of credit to a portion of the bank's own funds (such as equity and retained earnings) determined depending on the level of risk attributed to each borrower and transaction.[16] The rationale is that lending to borrowers deemed risky should require more "skin in the game" than lending to less risky borrowers. Given that raising regulatory capital is more expensive than deploying borrowed money,[17] banks are incentivized to limit risk exposure to maximize their return on equity. Nevertheless, the coefficients used to determine the level of risk for different classes of exposures are legally constructed and politically determined.[18] Hence, a gap between the actual risk of a deal and its regulatory classification may emerge. To exploit this gap, banks can structure their investments to reduce capital requirements even though the risk they face is materially higher (Jones 2000). For instance, until 2008, under unbelievably favorable regulatory treatment, securitization and other derivatives were engineered and sold mainly to reduce banks' regulatory capital.[19] When the GFC unfolded, and significant losses materialized, it became painfully evident that capital requirements did not capture the effective riskiness of these transactions. Hence, a process of reform was initiated.

Second, rules emerge, change, and evolve due to interdependence with social actors. Organizations "are both responding to and constructing the law that regulates them," rendering law endogenous to the areas it is intended to regulate (Edelman, Uggen, and Erlanger 1999, 407). Therefore, financial law and regulation include dialectic processes (Georgosouli 2010) and routinized procedures involving bureaucrats, lawyers, and back-office employees (Riles 2011, 10). Cooperation between market participants yields practices recognized and absorbed by the legal system. For instance, legal protection has been granted to standard-form contracts developed by business associations (Riles 2011, 169). Similarly, the Basel Framework has been designed around models first developed in the industry (Tarullo 2008, 178). Conflicts between market participants also engender extensive legal change. Simple dispute resolution mechanisms, involving two opposing parties and a dispute resolver, trigger a process that reshapes rules and relationships within social systems, tracing broader policy trajectories (Stone Sweet 1999).

16. In particular, it has been noted that "capital requirements control the quantity of credit circulating in the economy by binding its creation to an amount of equity [own funds] that is proportionate to the level of risk" to which banks are exposed (Castellano and Dubovec 2018a, 71).

17. Favorable tax treatment for debt instruments and guarantees protecting deposits render debt less expensive than regulatory capital—that is, a form of equity (Admati and Hellwig 2013, 110–11).

18. For instance, exposures to sovereign entities are often deemed risk free for capital requirements purposes even in circumstances where the ability of a given government to repay its obligation is questionable (Castellano and Dubovec 2018a, 76). Differently, movable assets commonly held by small businesses are not considered eligible to reduce capital requirements when used as collateral (Castellano and Dubovec 2018b).

19. For example, a few months before its near collapse, the American International Group (2008) reported to the US Securities and Exchange Commission that it had sold a large majority of its credit default swaps to banks for the purpose of reducing regulatory capital.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Third, interactions between the law and environment result in novel nonlinearities that disrupt the legal status quo and reshape the relationship between law and society. For instance, the interplay between law and technology does not simply result in new rules; it also changes how social actors interact with the legal system as compliance and decisions can be automatized and solutions based on artificial intelligence are increasingly deployed in legal processes traditionally requiring human intervention.[20] Similarly, the challenges of climate change have disrupted established legal institutions, resulting in completely new legislative frameworks and regulatory regimes to gauge novel risks and attribute responsibilities (Fisher, Scotford, and Barritt 2017). These dynamics indicate that law itself is subject to an ongoing process of innovation, which is often at odds with the idea that legal systems are stable but perfectly fitting with the notion of complexity.

FROM COSMOS TO CHAOS: THE EMERGENCE OF SYSTEMIC RISK

Complexity is neither inherently positive nor negative. Nonlinear interactions result in an order supporting core social functions. But they also generate disequilibria and, possibly, system-wide disruptions. Building upon the notion of complexity just introduced and drawing a parallel with disaster risks, this section completes the conceptual framework developed in this article; specifically, it indicates that financial systemic risk is endogenous to the financial system and that law contributes to its emergence.

Endogeneity of Systemic Risk

Disasters emerge from the complex interactions between fortuitous events, human activities, and social elements. In particular, the international community indicates that disasters result in "continuously present conditions of risk" as they depend on three factors: exposure to hazards, the vulnerability of societies, and the availability of resources to limit exposure and address vulnerabilities (United Nations 2016, 14). Disaster risk is, thus, the possibility—expressed in probabilistic terms—that a given hazard materializes in human, material, and economic or environmental losses that exceed the community's ability to cope using its own resources—that is to say, that disasters stem from the complexities of the systems they threaten.[21]

Accordingly, there is no such thing as a "natural" disaster. Although a hazard can be natural or non-natural (United Nations 2016, 18), the materialization of a disaster always depends on human factors (Farber et al. 2015, 3–4). Specifically, the risk of a disaster is directly proportional to both the hazard exposure and the vulnerabilities of the affected social systems but inversely proportional to its preparedness and response capacity. Hence, events that are external to a given social system, such as a novel

20. With the rapid diffusion of digital technologies and the advent of artificial intelligence, the way in which rules are analyzed, interpreted, and enforced has changed, possibly ushering in a new era of machine-led law making (Chen, Stremitzer, and Tobia 2022; Whalen 2022).

21. This definition is ubiquitous in the context of disaster risk reduction policies developed by the International Federation of Red Cross and Red Crescent Societies (n.d.), the United Nations (2016, 13), and the Organisation for Economic Co-operation and Development (2003, 51).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

disease, heatwaves, or an earthquake, are triggering factors that a system's nonlinear dynamics may (or may not) transform into a systemic failure, or into inter-systemic failures, when more social systems are affected concomitantly (Heyvaert 2022).[22] A system-wide disruption may be triggered by a relatively minor technical failure, as in the case of the Chernobyl accident in 1986, or by an external event that is not under direct human control, as in the case of the Fukushima Dai-ichi disaster in 2011 (Perrow 2011; Funabashi and Kitazawa 2012). Regardless, these events only escalate into disastrous consequences due to the nonlinear interactions within affected systems.

Similar dynamics can be observed in the financial context. The emergence and busting of price "bubbles" clearly illustrate the endogenous nature of financial systemic risk. Given that market participants tend to imitate a dominant investment strategy (Shiller 2008, 47), a self-reinforcing mechanism is initiated, conflating market prices through iterated trading activities (Sornette 2017, 52–54). A bubble forms when prices rise far above the actual value of the underlying assets and burst when a sufficient number of investors sell such assets, fearing further losses (Cunningham 1993, 594–95). For instance, a fall in housing prices, such as the one that occurred in 2007, is a shock that is exogenous to the choices of individual financial institutions. However, the growth and diffusion of financial products linked to the mortgage market supported the expansion of indebtedness and the rise of prices; the subsequent downfall of the housing market, in turn, triggered disinvestment strategies, whereby financial institutions purged depreciated assets to limit their losses (Adrian and Shin 2010; Shleifer and Vishny 2011). The ensuing herd-like behavior resulted in inflated sales, further depreciating financial assets and compromising the financial position of large financial institutions, such as Bear Sterns, JP Morgan Chase, and Lehman Brothers (Judge 2012, 145). When Lehman Brothers Holdings Incorporated (LBHI) filed for bankruptcy, investors, fearing further losses, closed out their positions *en masse*, depressing financial markets even further, while the US authorities decided not to bail it out.[23] The failure of LBHI is a manifestation of broader complex dynamics. The nonlinearities of the financial system, magnified by regulatory and legal frameworks unequipped to address system-wide disruptions, transformed losses of one hundred to two hundred billion dollars in subprime mortgage products into losses in the trillions, rampant unemployment, and a global recession with a persistent socioeconomic impact.

Endogeneity explains two fundamental dynamics of systemic risk. First and most fundamentally, the same nonlinear interactions transforming a set of seemingly unrelated interactions into a self-organized whole also engender the risk of its demise. Primarily observed in the natural world and in the context of disaster risks, the connection between complexity and instability has also been explored in finance.

22. The very notion of systemic risk is deployed to describe risks that pose threats beyond localized harms (Renn et al. 2022, 2). For instance, climate change and zoonotic diseases transcend geographical, social, and political boundaries. They require concerted policy responses to ensure effective adaptation (Anisimov and Magnan 2023, 14). But, more profoundly, they demand the redesign of regulatory responses to enact holistic strategies premised on early interventions (Heyvaert 2022, 939) and under a "planetary" legal framework that brings together the fragmented set of international environmental and global health law (Ip 2023, 1053).

23. For this reason, the failure of Lehman Brothers has been explained as "self-fulfilling contagious runs" (Scott 2016, 71–72).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Drawing from epidemiology and natural sciences, the fragility of the financial system has been explained as a result of its inherent complexities (Haldane and May 2011, 353). This explanation is consistent with the seminal work of Hyman Minsky (2015), who noted that financial instability is a cyclical phenomenon that emerges from a series of progressive phases and is fueled by an uncontrolled accumulation of debt. Crucially, risk taking and credit growth increase in a low-risk environment, rendering the financial system more fragile (Danielsson, Valenzuela, and Zer 2023). Hence, actions that ordinarily fulfill physiological market functions, such as investments, lending, or disinvestments, ultimately develop into an excessive accumulation of risk, reaching a breaking point represented by a diffused inability to service debt obligations. Looking at the interactions between market participants, Steven Schwarcz (2008, 206) persuasively noted that financial systemic risk results from a "tragedy of the commons, in which the benefits of exploiting finite capital resources accrue to individual market participants, each of whom is motivated to maximize the use of the resource." This is to say that market participants are not naturally incentivized to maintain financial stability; the rent-seeking behaviors of firms, if left unchecked, stimulate excessive risk taking and widespread distress.

Nonlinear interactions between market participants can also cause financial instability when reacting to external events, such as deteriorating economic conditions. Similar to an epidemic outbreak where people react with "flight or hide" behaviors to minimize the risk of getting infected (Epstein et al. 2008, 1), a change in economic conditions can prompt depositors, investors, and lenders to withdraw their funds, disinvest, and withhold capital. Unlike during epidemics, when flight strategies spread disease and hiding lowers the transmission rate by limiting social contact, the indiscriminate withdrawal of funds (flight) or the hoarding of capital (hide) from the financial system generates contagion. This outcome is also a manifestation of the adaptive strategies of market participants. Profit-seeker investors and risk-averse depositors react to real (or perceived) risks. In anticipation of potential losses, investors hold on to their capital, whereas depositors "run to the bank" to withdraw their savings. Collectively, these actions reinforce asset depreciation, limit liquidity, erode confidence across the system, and, without any public intervention, may determine chain reactions, known as contagion, whereby (relatively) healthy financial institutions fail. Irrespective of the triggering event, systemic risk is a product of the complexities of the financial system.

Second, the more complex a system, the higher the chances of instability. This is a direct consequence of the observation that complex (social or natural) systems exist in a far-from-equilibrium state, as they sharply transition from stable to unstable once their complexity exceeds a critical threshold. With the proliferation of interdependencies and recursive interactions, the nonlinearities of complex systems intensify, and the possibility of small events triggering significant system-wide failures grows (May 1972, 414). In epidemiology, for instance, multiple interactions between individuals exponentially increase the transmission rate of disease (Kucharski 2020, 25). In industrial organizations, high technical and organizational complexity results in a higher probability of system-wide failures, rendering industrial accidents a "normal" occurrence (Perrow 1984). Similarly, the complexities brought by financial innovation (Judge 2012, 158), technological advancements (Omarova 2020), and the burgeoning

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

interconnectedness of financial institutions (Haldane and May 2011, 352) create new risks and new vulnerabilities.

The 2023 banking crisis provides clear evidence of these dynamics. The failures of SVB and CS had a variety of different underlying causes, but they shared at least one commonality: they showed how social media, in combination with digital banking, created new complexities that amplified the endogenous dynamics of systemic risk. Following a series of heavy investments in long-term bonds during a period of low-interest rates and booming deposits—primarily gathered from technology-intensive start-ups and venture capital-backed companies—SVB experienced significant losses when interest rates were increased to combat inflation and the value of its assets fell (Federal Reserve 2023, 25). Following the voluntary liquidation of a technology-focused bank, Silvergate Bank, SVB attempted to reassure depositors and investors by communicating its intention to shore up new capital to absorb part of its losses. This decision did not yield the desired effect. On March 9, SVB's clients withdrew forty-two billion dollars in a single day.[24] Coordinated via online platforms and executed through online banking services, their actions resulted in the fastest bank run to date. Expecting an additional outflow of one hundred billion dollars and lacking the liquidity necessary to meet such rapid drainage, SVB was closed and placed into receivership the following day (Federal Reserve 2023, 24). But fear spread further through social media, causing a rapid flight of funds from regional mid-sized banks, resulting in the closure of Signature Bank on March 12 (New York State Department of Financial Services 2023) and the liquidation of First Republic Bank on May 1.[25] Internationally, a similar plot resulted in the demise of CS, a systemically important financial institution at the global level (a global systematically important financial institution).[26] After years of difficulties, speculations of its imminent collapse circulated across the Internet, resulting in an outflow of over $120 billion in the last three months of 2022. Yet, as contagion spread beyond the United States, a new wave of withdrawals started soon after SVB's failure, requiring Swiss authorities to halt the bleeding by orchestrating the emergency acquisition of CS by UBS Financial Services on March 19.[27]

These cases are not anomalies. They reflect the process of innovation that reshapes the interactions among the components of the financial system and within its environment. A new path is thus traced, disrupting the existing status quo. Bank runs have occurred throughout financial history; rumors have often been their precursor, and deposit insurance their cure (Diamond and Dybvig 1983). Yet in a highly financialized and digitalized economy, the relationships between social actors have changed. As individuals have gained constant access to cash and information, rumors can avalanche into a system-wide disruption at lightning speed.

24. California Department of Financial Protection and Innovation, *Order of Taking Possession of Property and Business in the Matter of Silicon Valley Bank*, March 10, 2023.

25. California Department of Financial Protection and Innovation, *Order of Liquidation in the Matter of First Republic Bank*, May 1, 2023.

26. Global systematically important financial institutions are identified by the Financial Stability Board (2010), which also sets the criteria to determine whether a financial institution is systemically important.

27. Swiss Federal Council Ordinance on Additional Liquidity Assistance Loans and the Granting of Federal Default Guarantees for Liquidity Assistance Loans from the Swiss National Bank to Systemically Important Banks, March 16, 2023, 23–24, amended by the Swiss Federal Council, March 19, 2023.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Law and Systemic Risk

Embedded in the fabric of social systems, law is part of the complexities that may give rise to systemic risk. Rules, principles, and institutional arrangements are social constructs that govern, organize, and facilitate social endeavors and interactions. The same legal constructions that support the emergence of a self-organized structure may also threaten its functioning. Legal institutions, in fact, influence the ability of societies to curb systemic risks by increasing or reducing exposures to potential threats as well as the vulnerabilities and preparedness of social systems. For instance, land law rules, urban planning, and conservation requirements, through the implementation of calibrated restrictions, are essential to reduce the probability and impact of a wide range of disasters arising from flooding and earthquakes (Farber et al. 2015, 29–31) as well as diseases and climate change (Heyvaert 2022, 960). However, regulatory measures often adopted to curb risks in the short term may thwart long-term prevention and generate new vulnerabilities.[28] Similarly, public funds, private insurance, and risk-transfer mechanisms influence the incentive structure of social actors, thus promoting or discouraging investments in preventive measures and recovery plans (Monti 2009, 158; Castellano 2010, 404–6). More broadly, the institutionalization of emerging systemic risks, such as those related to new technologies or climate change, poses significant normative challenges, disrupting established legal concepts and often requiring decisions to be taken in circumstances of scientific uncertainty (Fisher, Scotford, and Barritt 2017, 179–81). The ensuing legal nonlinearities may increase, rather than reduce, risk exposures and vulnerabilities.

Finance is no exception. While premised on legal certainty and predictability, rules may be a source of instability.[29] The legal shockwaves triggered by the failure of Lehman Brothers offer a powerful illustration of this dynamic. On September 15, 2008, LBHI filed for Chapter 11 bankruptcy protection, marking the largest bankruptcy in US history (Scott 2016, 19) and spawning an intricate nexus of insolvency proceedings across various jurisdictions (Bridge and Braithwaite 2013; Braithwaite 2014). Following LBHI's demise, Lehman Brothers International (Europe), the London-based regional headquarters, was placed into administration, sparking a dispute on the applicability of English property and trusts law concerning the segregation and pooling of clients' funds.[30] Prior to the

28. Although this article focuses on financial regulation to indicate that rules may amplify financial instability when they neglect the complexity of finance, similar considerations can be advanced in the context of non-financial systemic risks. The literature on risk regulation is, unfortunately, rich in examples of rules that fail to address complex risks and contribute to the emergence of system-wide disruptions (Hood, Rothstein, and Baldwin 2001, 24; Hutter 2006; Black 2014; Heyvaert 2022). Beyond legal and sociological scholarship, an illustration of this dynamic has been offered in the context of climate risk adaptation policies, where the term "maladaptation" was introduced, for instance, to describe the negative impact of seawalls on stimulating long-term resilience strategies (Magnan, Anisimov, and Duvat 2022).

29. This point echoes the "law and finance paradox," indicating that, while finance is legally constituted, the concomitant enforcement of legal commitments may hamper its stability (Pistor 2013, 323).

30. Failure to segregate client money from the firm's own fund was central in the Lehman Brothers case that took several years and started with the decision of the High Court in *Re Lehman Brothers International (Europe)*, [2009] EWHC 3228 (*Lehman Brothers* 2009), and continued before the Court of Appeal in *Re Lehman Brothers International (Europe) (In Administration)*, [2010] EWCA Civ 917. Ultimately, in *Re Lehman Brothers International (Europe) (In Administration)*, [2012] UKSC 6, the US Supreme Court accorded the maximum level of protection to clients, emphasizing the mismanagement of the company and favoring the application of European Union law over the general principles of English trust law (Lee 2012).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

commencement of insolvency proceedings in the United Kingdom, however, the German supervisory authority, the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin), issued a moratorium,[31] halting all payments and operations of Lehman Brothers Bankhaus AG (Hofmann 2011, 468). While intended to facilitate orderly liquidation in the context of normal corporate insolvency (Singh 2020, 174), such a moratorium caused Lehman Brothers Bankhaus AG to default on all short-term obligations before any restructuring could occur. Moreover, it further compromised the position of the group, rendering uncertain the amount that clients could recover from the liquidation of Lehman Brothers International (Europe).[32] Other than identifying the shortcomings of cross-border insolvency regimes, these events indicate that legal nonlinearities play a role in the emergence of systemic risk. This is to say that law, unwittingly or by design, may exacerbate financial instability.

The impact of legal non-linearities on the emergence of system-wide disruptions can also be observed at the macro level when regulatory changes are examined. While financial regulation is not solely crisis driven and reflects a larger process of policy innovation (Conti-Brown and Feinstein 2021), the alternation between regulatory relaxation and regulatory tightening is a common dynamic. Owing to the convergence of ideological and political interests (Harvey 2007), regulatory capture (Baker 2010) and, more broadly, liberalization and deregulatory initiatives (Born 2011; Stiglitz 2015, 23–24) are often indicated as the root of recent financial crises. The flaws exposed in the aftermath of a crisis, in turn, trigger the implementation of more stringent regulatory regimes that are diluted during periods of relative stability (Snider 2011). Yet the perspective adopted in this article indicates that changes introduced in the aftermath of a crisis or during a period of perceived stability may equally contribute to financial instability.

Consistent with the notion that law is an agent of complexity introduced earlier, law may contribute to financial instability during regulatory easing and tightening periods. Regarding periods of regulatory easing, the deregulatory initiatives that preceded the 2023 banking crisis in the United States exemplify this dynamic. Enacted as a response to the failure of LBHI, section 165 of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Dodd-Frank Act) contains measures to address the "too-big-to-fail" problem by establishing a standardized set of enhanced prudential standards for banks that are classified as systemically important.[33] In 2018, however, the Economic Growth, Regulatory Relief, and Consumer Protection Act (EGRRCPA) amended section 165 in two ways: it raised the minimum asset threshold for applying enhanced prudential standards from $50 billion to $250 billion, and it mandated the Federal Reserve to enact a tailored approach for banks with total assets between $100 billion and $250 billion.[34]

31. This action was in line with former section 46a of the Gesetz über das Kreditwesen (KWG). The KWG was amended by the Act Adjusting Financial Market Legislation (Gesetz zur Anpassung von Gesetzen auf dem Gebiet des Finanzmarktes), July 15, 2014, Federal Law Gazette I, 934.

32. In England, the High Court noted that "[t]he Administrators [of Lehman Brothers International (Europe) Ltd] have been unable even to hazard a guess at the amount, if any, of client money which may be recovered from Bankhaus." *Lehman Brothers* 2009, para. 6.

33. Dodd-Frank Wall Street Reform and Consumer Protection Act, July 21, 2010, 124 Stat. 1376 (Dodd-Frank Act).

34. See Economic Growth, Regulatory Relief, and Consumer Protection Act, May 24, 2018, 132 Stat. 1296.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

In a general political climate where supervisory enforcement was actively discouraged (Snider 2020), the Federal Reserve enacted a lengthy and elaborate matrix of bank-specific parameters to effect the EGRRCPA provisions.[35] As a result, mid-sized banks, such as SVB and Signature Bank, were not treated as systemically important and were not subjected to the standardized and enhanced requirements but, instead, to a tailored approach. Ironically, five years later, facing an exceptionally fast bank run driven by unsecured depositors, the Department of the Treasury, in coordination with the Federal Reserve and the Federal Deposit Insurance Corporation,[36] invoked the risk of a systemic failure in order to resolve SVB and Signature Bank in a manner that would protect all depositors (insured and uninsured). The Federal Reserve (2023, 10; emphasis added) later indicated that the "tailoring approach in response to EGRRCPA and a shift in the stance of supervisory policy impeded effective supervision by reducing standards, *increasing complexity*, and promoting a less assertive supervisory approach." This is to say that a reform enacted to reduce regulatory pressure generated new nonlinearities that required exceptional public measures to avert a system-wide disruption.

Regulatory regimes implemented to foster financial stability may have similar effects. For instance, risk-based capital requirements tend to incentivize investments during good economic times as the risk of failure on individual investments is perceived as being lower when the general economic outlook is positive. However, during an economic downturn, capital requirements incentivize financial institutions to adopt a more conservative approach by limiting lending and, possibly, liquidating their position (Black 2012, 1046; Awrey and Judge 2020, 2334). Similarly, mark-to-market accounting rules, whereby the value of an asset should reflect current market prices, push financial entities to mark down their assets to fire sale prices, forcing otherwise solvent firms to liquidate depreciated assets (Schwarcz 2009, 232; Scott 2010, 674). Another paradoxical result emerges: rules designed to promote the soundness of the financial system may amplify the cyclical movements of markets.

New rules have been implemented to address the critical flaws unveiled by the GFC. For instance, a new set of international standards has been adopted to ensure the orderly resolution and liquidation of troubled financial institutions. Specifically, according to the *Key Attributes of Effective Resolution Regimes for Financial Institutions*, distressed financial institutions should continue critical economic functions, and early termination of rights should be avoided (Financial Stability Board 2014).[37] Moreover, starting from 2011 with a progressive implementation to be completed by 2028, the Basel Framework has been amended.[38] While the core structure and risk-based rationale have been maintained,

35. Prudential Standards for Large Bank Holding Companies, Savings and Loan Holding Companies, and Foreign Banking Organizations, 84 Fed. Reg. 59032 (November 1, 2019) (codified at 12 CFR Parts 217, 225, 238, 242, 252).

36. See Department of the Treasury, Federal Reserve, and Federal Deposit Insurance Corporation 2023.

37. Key Attribute 4.3 and I-Annex 5 (Financial Stability Board 2014).

38. In the aftermath of the GFC, the Basel Committee on Banking Supervision started a process to amend the Second Basel Accord (Basel II) adopted in 2004 and revised in 2006. See Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework, 2006. As a result, a Third Basel Accord (Basel III) was adopted and completed in 2017. See Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems, 2011. Basel III has been further adjusted and its provisions have been consolidated in the Basel Framework.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

specific measures have been introduced to curb the cyclical movements of markets. Most notably, financial institutions that are deemed systemically important have been required to implement a counter-cyclical buffer, consisting of a cushion of capital that banks must maintain when their balance sheet is expanding (during good times) and release to absorb losses when a contraction occurs (during bad times).[39]

Similarly, a novel leverage ratio has been implemented, requiring banks to maintain a minimum amount of regulatory capital relative to their total assets. This new ratio is not riskbased: it is not intended to reflect the level of risk associated with any specific exposure; instead, it has been designed to counteract the accumulation of excessive leverage in the banking system and subsequent deleveraging during an economic downturn.[40] The newly introduced counter-cyclical buffers helped to mitigate the adverse economic impact of the COVID-19 pandemic; by releasing the buffer, banks were encouraged to lend even if the economy halted. Other measures, however, heightened systemic distress. For instance, to keep the statutory ratio between total assets and regulatory capital, banks were disincentivized to purchase US treasuries when, at the outset of the COVID-19 crisis, investors in need of cash wanted to sell them. To avoid a systemic disruption and inject liquidity, the Federal Reserve had to purchase an unprecedented sum of treasuries while temporarily excluding treasuries and cash reserves from the calculation of the leverage ratio (Kress and Zhang, forthcoming, 52).

The observation that easing or tightening regulatory requirements may equally contribute to the emergence of systemic risk does not imply that nothing can be done. Financial crises like disasters are inevitable, but their likelihood and impact can be minimized once system-wide dynamics are understood and addressed. Yet, notwithstanding the monumental reforms implemented in the aftermath of the GFC, the normative premises for financial regulation to address systemic risks have remained unaltered. Specifically, as further illustrated in the next section, existing regulatory policies neglect complexity and conceive both systemic risk and law as exogenous to market dynamics: the former is an anomaly; the latter is its cure.

THE INSTITUTIONALIZATION OF FINANCIAL SYSTEMIC RISK

The definition of systemic risk determines its policy response. It is "an exercise of power" (Slovic 1999, 699). This dynamic is evident in the context of finance, where solutions to address financial systemic risk stem from its definition (or lack thereof) and are prone to political and ideological interference. In fact, the deregulatory emphasis that reigned until the GFC resulted in the exclusion of systemic risk from the mandate of supervisory agencies.[41] As firms were deemed to limit excessive risk taking while

39. According to the Basel Committee on Banking Supervision, "[t]he counter-cyclical buffer aims to ensure that banking sector capital requirements take account of the macro-financial environment in which banks operate." See Basel Framework, RBC30.6.

40. The methods to calculate the leverage ratio are contained in Basel Framework, LEV20.

41. For instance, in the United Kingdom, Her Majesty's Treasury rejected the request of Parliament to include the prevention of systemic risk and the maintenance of financial stability as a policy objective of the (now dismantled) Financial Services Authority. See HM Treasury, *Financial Services and Markets Bill: Government Response to the Reports of the Joint Committee on Financial Services and Markets*, [1999] HL Dep. 99/1212.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

maximizing their returns, regulatory interventions aimed at limiting an excessive accumulation of risk were considered to weaken the natural capacity of financial markets to deal with crises (Kaufman and Scott 2003, 385). Therefore, financial stability was primarily understood as an ancillary policy objective, achieved by maintaining the solvency of individual financial institutions.

The GFC revealed the flaws of such an understanding. As a result, post-crisis reforms have been focusing on implementing macro-prudential regulatory regimes—intended to protect the stability of the financial system in its entirety—while strengthening micro-prudential regulation—focused instead on the solvency of individual financial institutions (Borio 2003; Lastra 2015; Cranston et al. 2018, 31).[42] A regulatory definition of financial systemic risk was thus forged. However, as indicated in this section of the article, regulatory solutions are still constrained by a conceptual framework that depicts systemic risk as independent from market-wide dynamics and law as a corrective device.

Financial Regulation and the Exogeneity of Systemic Shocks

In 2009, as the GFC unfolded, the International Monetary Fund, the Bank for International Settlements, and the Financial Stability Board (2009, 2) defined systemic risk as "[a] risk of disruption to financial services that is (i) 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." While seemingly reflecting the endogenous nature of systemic risk, closer inspection reveals that this definition is incomplete and does not support a genuinely systemic view. Constructed as a tautology—where a potential "disruption" results from an "impairment"—the definition neglects the relationship between systemic risk and financial dynamics. Unlike disaster risk governance, financial regulation falls short of indicating that finance exists under a constant condition of risk as potential damages to the financial system are a function of its vulnerabilities and preparedness for reoccurring disturbances. This is not to say that existing policy responses are not geared to address vulnerabilities altogether. For instance, building upon the above definition of financial systemic risks, the International Monetary Fund, the Bank for International Settlements, and the Financial Stability Board (2016, 4) have indicated that macro-prudential regulation should limit systemic risk by addressing vulnerabilities related to both "the build-up of risks over time" and "the interconnectedness and the associated distribution of risk within the financial system." However, this understanding of vulnerability reveals fatal ambiguities once juxtaposed with the one adopted to mitigate disaster risks. Disaster risk governance defines vulnerability as a scalar variable that gauges the idiosyncratic ability of actors and systems to absorb or suffer damages resulting from identified hazards.[43] Therefore, the

42. Andrew Crockett (2000), while serving as the general manager of the Bank for International Settlements and the chairman of the hitherto Financial Stability Forum, noted that "the macro-prudential dimension focuses on the risk of correlated failures," whereas "[t]he micro-prudential dimension … considers each institution in its own right, and is thus not concerned with correlations per se."

43. Ortwin Renn (2008, 65) explains that vulnerability "describes the various degrees of the target [such as a social system, a community, or an individual] to experience harm or damage as a result of the exposure" (Renn 2008, 65).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

build-up of risk and the interconnectedness amongst its components are not vulnerabilities *per se*; they are a manifestation of complex dynamics that may contribute to the emergence of a systemic failure if (and to the extent to which) the affected system is unable to absorb losses.

Premised on a limited understanding of the complex dynamics, regulatory regimes addressing systemic risk suffer from critical flaws. First, although the prevention of systemic risk ranks now as one of the primary objectives for financial regulators, its incomplete understanding results in vague policy mandates. In the United States, for instance, the Financial Stability Oversight Council (FSOC), comprised of the heads of the major regulatory agencies chaired by the secretary of the Treasury, has been entrusted to "identify risks" and "respond to emerging threats to the stability of the United States financial system."[44] In practice, the FSOC acts as a coordination body and is only entrusted with the powers of designating systemically important financial institutions (therefore, subjecting them to the Federal Reserve's enhanced supervision) and issuing nonbinding recommendations to regulatory agencies (Kress, McCoy, and Schwarcz 2019, 1473). Crucially, systemic risk is not institutionalized as a function of system-wide dynamics but, rather, as a disruption arising from different events that regulatory agencies must identify.

Second, systemic risk is construed as a phenomenon exogenous to financial dynamics as it rests outside the control of individual financial institutions. This understanding is embedded in the risk models developed by the industry and further reflected in capital requirements adopting the value-at-risk (VaR) methods. VaR models are intended to estimate the maximum loss that an investment portfolio might suffer over a given period and with a certain level of probability (or "confidence interval").[45] Their construction requires a vast amount of data typically gathered from the observations of small and frequent gains and losses routinely incurred by financial institutions (Danielsson 2008, 326). In these models, system-wide disruptions are not gauged as they are deemed independent from the choices of individual financial institutions (Danielsson and Shin 2003, 87). Losses generated by system-wide disruptions, such as a financial crisis, are reflected indirectly in historical observations of smaller events, provided that such occurrences fall within the observed period.

Hence, following traditional economic theory, the activities of financial institutions in response to a shock are considered not to affect the formation or amplification of systemic risk because, in perfectly competitive markets, every economic agent is considered a price taker (that is, it cannot solely influence a change in prices). Although it is recognized that VaR models are not designed to measure systemic risk (Danielsson 2008, 327), their use is ubiquitous and embedded in financial regulation.

44. See the Dodd-Frank Act, art 112(a)(1). For a critique of the reform, see Allen 2015. Similarly, in the United Kingdom, the Financial Policy Committee has been tasked to identify, monitor, and take actions "to remove or reduce systemic risks" intended as "a risk to the stability of the United Kingdom financial system as a whole or of a significant part of that system," although it is expressly indicated that "it is immaterial whether the risk arises in the United Kingdom or elsewhere." See Financial Services Act 2012, c. 21, ss. 9C, (2), (5), (6).

45. For instance, if the specified period is ten days and the confidence level is 99 percent, value-at-risk (VaR) models based on historical data on market tendencies would offer an estimation of the greatest loss in value that has more than a 1 percent chance of occurring in ten days.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

In particular, a few years after their deployment in the financial industry, VaR models were included in the Basel Framework and, thus, elevated to a global regulatory standard.[46] In ensuring a consistent homogenous application of international capital requirements, a paradoxical result may ensue: every firm in the financial system considers systemic risk to be a variable that is unrelated to its actions. This understanding is also reflected in the methodology adopted to conduct stress testing—a technique often hailed as an example of the macro-prudential ethos of post-GFC reforms. Stress tests are simulations (based on hypothetical but possible scenarios) run by regulators to identify criticalities affecting markets, transactions, and firms (Armour et al. 2016, 428). Depending on the outcome, additional capital requirements may be imposed. While intended to remedy the shortcomings of capital requirements calculated at the individual level, the Federal Reserve deploys an equilibrium model to analyze how each financial institution, discretely considered, would react to an exogenous shock (Enriques, Romano, and Wetzer 2019, 370). Second-order consequences and feedback loops resulting from the interaction between market participants are excluded.

All in all, the institutionalization of systemic risk as a phenomenon external to individual financial institutions' decisions is paired with the notion that markets lean toward a natural state of equilibrium. As discussed below, this understanding reflects a broader, reductionist view that discounts complexity to explain core financial dynamics.

The Stability of Reductionism and the Exogeneity of Law

Implicit in financial regulation is the notion that finance tends toward stability, represented by an optimal equilibrium. From a normative standpoint, this assumption has two critical implications. First, markets are considered to have the almost thaumaturgical ability to self-heal. Because shocks are assumed to be an external factor that affects prices, market participants are deemed to adapt to price changes, thus reaching a new equilibrium. The confidence in the ability of the financial system to correct itself caused regulators to refrain from intervening in the early signs of financial distress in 2007. In October 2008, during a historic hearing in the US Congress, Alan Greenspan, former chairman of the US Federal Reserve, admitted that the decisions of the Federal Reserve in the early days of the GFC were taken under the assumption that the market would correct itself.[47] Greenspan further added that such an assumption—referred to as an "ideology" or a "view of the world"—was flawed.[48] Yet, post-crisis reforms have not provided an alternative view of the world as systemic risk is still considered an exogenous anomaly causing a departure from the natural state of equilibrium.

Second, the equilibrium assumption is a benchmark to determine when regulation is justified. Accordingly, any form of regulatory intervention is needed only when financial markets cannot reach an optimum due to imperfections that limit the ability of

46. Banks may use internal models based on the VaR to estimate counterparty credit risk and determine the relevant amount of regulatory capital. See, in particular, Basel Framework, CRE32.39–41.

47. US Congress, Committee on Oversight and Government Reform, *The Financial Crisis and the Role of Federal Regulators*, House Hearing no. 110-209, October 23, 2008.

48. In particular, Alan Greenspan noted: "I found a flaw in the model that I perceived is the critical functioning structure that defines how the world works." See US Congress, *Financial Crisis*, 46.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

individuals to engage in private negotiations (Baldwin, Cave, and Lodge 2012, 15). Such imperfections could result from market failures such as monopolies and asymmetries of information (Bator 1958),[49] in addition to transaction costs, representing the costs incurred when participating in economic exchanges (Coase 1937). According to this view, if transaction costs and market failures were hypothetically absent, legal institutions would be unnecessary or even irrelevant, given that the parties to any economic transaction would be free to negotiate their rights and obligations to maximize their idiosyncratic preferences.[50] However, since market imperfections exist in the real world, this logic indicates that law should be crafted to facilitate private negotiations, which, in turn, are expected to restore the natural equilibrium.

Such an understanding implies that legal and regulatory norms perform a corrective function and, thus, are external to the dynamics of markets.[51] Accordingly, legal and regulatory norms are considered to facilitate or stifle market development by reducing or increasing transaction costs and market failures. However, they are not considered intertwined with economic dynamics, nor is it deemed essential for the functioning of the markets. While market failure rationale may be a simple but effective diagnostic tool for identifying and addressing specific issues, such as the asymmetries of information in individual transactions, its applicability in other contexts is problematic.[52] Critically, as further indicated below, it is unequipped to grasp system-wide, complex dynamics.

The Market Failure Fallacy

In finance, systemic risk falls under the rubric of market failures. Specifically, systemic risk has been qualified as a negative externality, which is a cost not accounted for in market prices, like pollution (Buchanan and Stubblebine 1962; Dahlman 1979).[53] Therefore, a systemic failure disrupts market dynamics because it imposes costs for which individuals neither accept nor receive retribution. Consequently, the optimal allocation of resources ensured by the market's invisible hand cannot be attained, and public intervention is justified. To restore the market's dynamics, neoclassical

49. The concept is attributed to John Stewart Mill (1869).

50. This corollary is known as the "irrelevance of the law," and it is one of the normative implications of Coase's (1960, 10) analysis.

51. Katharina Pistor (2013, 325) notes that orthodox economic theory considers "law and finance as separate spheres that are related in a causal, unidirectional fashion, not as structurally intertwined."

52. For instance, commentators have noted the limits of the market failure rationale to attain broader social objectives and, thus, the need to devise different risk regulation regimes (Hood, Rothstein, and Baldwin 2001, 171; Alemanno 2016; Baldwin, Cave, and Lodge 2012, 22).

53. Textbooks in financial regulation typically refer to systemic risk as an example of negative externalities that justify regulatory intervention (Moloney 2012, 436; 2023, 349; Armour et al. 2016, 59). More granular analyses typify various imperfections that contribute to the emergence of system-wide disruptions to determine the most appropriate response (Schwarcz 2019, 36–41). Policy makers refer to systemic risk as a negative externality bluntly, further revealing the flawed institutionalization of this phenomenon. For instance, the International Monetary Fund, the Bank for International Settlements, and the Financial Stability Board (2016, 4) aporetically indicated that "[f]undamental to the [systemic risk] definition is the notion of negative externalities from a disruption or failure in a financial institution, market or instrument."

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

economics requires bringing such non-negotiated costs within a transactional framework. A tax on firms or activities generating negative externalities is a typical solution to ensure that the cost of externalities is borne by those causing them. Such a fiscal levy, known as the "Pigouvian tax" from British economist Arthur Cecil Pigou (2013), is determined by calculating the expected overall costs of a given negative externality and the marginal contribution of each firm to the expected losses, net of any social benefits.

Although the original theory has been heavily criticized, also by Ronald Coase (1960),[54] it gained some traction in different policy circles, as the carbon tax exemplifies. Since pollution is perceived as a negative externality, putting a price on greenhouse gas emissions has been considered an effective tool to reduce carbon emissions, as the cost of pollution is transferred to firms and, ultimately, to consumers. Drawing from the recognition that carbon taxes contribute to reducing greenhouse emissions (Haites 2018), proponents of a Pigouvian tax to redress financial systemic risks suggest that large financial institutions should be charged a finely geared levy that is designed to cover *pro rata* the losses of their potential failure (Acharya et al. 2013, 229; Masciandaro and Passarelli 2013; Poledna et al. 2020). However, this approach presents some fatal issues.

A financial crisis, like a disaster, cannot be reduced through an *ex ante* compensation of its potential damages. Leaving aside any ethical considerations, a Pigouvian tax is effective only if it accounts for all the possible losses that a systemic failure brings with it. But, for financial systemic risk, the total damages can be larger than the capitalization of the financial system since the broad economy may suffer. Furthermore, regardless of its feasibility, even a hypothetical, perfectly calibrated tax would not limit the likelihood or the impact of system-wide disruptions for it does not entail a reduction of existing vulnerabilities or increased preparedness. Environmental policies offer conclusive evidence of this point. As carbon taxes are intended to increase the cost of socially undesirable activities, they are effective only when they can shift consumers' preferences toward more environmentally sustainable activities (Metcalf 2009). However, since alternatives to the traditional financial industry (if available) are offered through unregulated entities, a Pigouvian tax would steer customers toward unregulated markets, thus creating new nonlinearities.

Similar considerations can be advanced for other regulatory remedies designed to address financial systemic risk as a form of market failure. The cost of complying with regulatory standards limiting excessive risk taking has been considered akin to a Pigouvian tax (Bernanke 2016; Levine and Macey 2018). Assessments of domestic post-crisis reforms, such as the Dodd-Frank Act, reveal that, while specific issues have been addressed, unintended consequences have emerged (Baily, Schardin, and Swagel 2016). The increased amount of regulatory pressures on large financial institutions, particularly banks, have spurred the development of a more opaque, less regulated sector, such as the "shadow banking" sector, wherein a new network of complexities arose amongst

54. In his sharp critique, Ronald Coase (1960, 39) noted, "[i]t is strange that a doctrine as faulty as that developed by Pigou should have been so influential, although part of its success has probably been due to the lack of clarity in the exposition. Not being clear, it was never clearly wrong."

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

financial institutions that are substantially similar to traditional banks but fall outside the regulatory purview (Awrey and Judge 2020, 2304).

The preceding analysis indicates that the current institutionalization of systemic risk within financial regulation is incompatible with the notion that finance is a complex social system. As long as finance is understood as a linear system leaning toward a natural state of stability and law is conceived as an exogenous remedy, regulatory actions remain confined within narrow boundaries. Attempts to curb systemic risk, at best, address specific facets, but their broader effects on the stability of the financial system will remain uncertain and potentially detrimental. New solutions require a different conceptual framework, one that does not exclude complexity *a priori*.

GOVERNING FINANCIAL SYSTEMIC RISK: FROM REDUCING COMPLEXITY TO EMBRACING IT

Regulatory strategies to address the complexity of systemic risk are confronted with a dilemma: can complexity be controlled and, if so, how? Seen as a solution to complexity, simplicity has been considered a priority for financial regulation. Reducing complexity both in finance and law is the recurring recommendation for excessively opaque entities and transactions (Schwarcz 2009; Utset 2011; Awrey 2012; Judge 2012; Roe and Troge 2018) as well as for overly intricate and voluminous regulatory regimes (Aikman et al. 2021). Upon closer examination, however, attempts to reduce complexity appear to be ill-fated: simplicity can be attained in complicated systems, whereas complex systems cannot be simplified without changing their very nature.

Since complexity cannot be eliminated, it must be embraced. Embracing complexity, however, does not imply a laissez-faire approach. It means recognizing that at the heart of any systemic risk lies a set of dynamics that cannot be fully controlled. Therefore, regulation should focus on those system-wide variables that can be (at least partially) controlled—namely, structural vulnerabilities and preparedness. Although improving the resilience of the system is an objective that threads together disaster risk reduction (van Asselt and Renn 2011) and financial stability policies (Haldane, Hall, and Pezzini 2007), the governance approach for non-financial and financial systemic risks is starkly different. To prove this point and demonstrate that new solutions can be envisaged once complexity is embraced, the remainder of this section examines the limits of regulatory simplicity and advances a novel approach for financial systemic risk governance akin to the one developed for disaster risk.

The Limits of Simplifying Complexity

Ambitions to reduce complexity in finance face fundamental limitations. First, complexity is an inherent feature of finance and, therefore, is not necessarily undesirable. Hence, regulatory simplification should target, at least theoretically, only those nonlinearities that are deemed to add to the instability of the financial system. In practice, however, this task is unattainable. Consistent with the irreducibility property, since the behaviors of complex systems cannot be inferred from the behaviors of their

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

components, it is impossible to connect a specific dynamic to a given outcome. This point is also directly observable in the context of regulatory attempts to govern financial innovation.

As a propelling force stimulating the emergence of the financial system and a potential source of instability, the impact of any given financial innovation cannot be assessed *a priori*. In some instances, innovation may result in a simplified user experience while concealing significant organizational complexities. Mobile banking services, for instance, have simplified user experience and promoted financial inclusion while relying on articulated data governance frameworks (Arner, Castellano, and Selga 2023, 253–72). Nonetheless, they have invertedly resulted in new fragilities, as epitomized by the 2023 digital bank runs. In other circumstances, the complexities brought about by innovations reveal their positive or negative social effects only over time. For instance, the emergence and diffusion of new digital assets deploying distributed ledger technologies (or "crypto assets") has been indicated as a potential source of systemic risk (Financial Stability Board 2023). Yet their diffusion is prompting radical changes in the supply of money, possibly reducing the risk of liquidity crises. Jurisdictions are currently exploring the possibility of issuing digital currencies that are directly linked to, and guaranteed by, the issuing central bank. As a result, commercial bank deposits and the fractional reserve system may become a thing of the past, granting individuals direct access to a perfectly liquid monetary instrument. This new form of digital money has evolved from crypto assets (Dell'Erba 2019; Buckley et al. 2021; Jackson 2022) to deploy a technology that, ironically, was popularized by bitcoin with the promise of subverting traditional monetary and payment systems.[55] This indicates that whether the complexity stemming from these (or other) financial innovations yields any socio-economic benefit cannot be determined in advance.

A second fundamental problem that may compromise regulatory approaches aimed at reducing complexity relates to legal nonlinearities. As an agent of complexity endogenous to finance, law contributes to the emergence of the financial system and systemic risk. Hence, consistent with the "butterfly effect," noted earlier, even a simple set of rules can bring forth momentous consequences as market participants react strategically to any change in the system. The evolution of international capital adequacy standards enshrined in the Basel Framework illustrates this dynamic. For half a century, the Basel Framework has undergone profound changes reflecting a tension between simplicity and granularity (Tarullo 2008). To limit strategic behaviors, policy makers have overhauled the initial approach to capital regulation, which was praised for being straightforward but not sufficiently precise, in favor of a more granular approach intended to reflect more accurately the level of risk taken by banks. However, such an increased risk sensitivity also significantly increased complexity without necessarily disincentivizing regulatory arbitrage practices (Romano 2014; Gerding 2016). Not surprisingly, the Basel Framework is still primarily criticized for its intricacy, which is deemed to compromise its effectiveness (Aikman et al. 2021, 328). Nevertheless,

55. The technical foundation for bitcoin was laid in a white paper published under the pseudonym of Satoshi Nakamoto (2008). The document proposed a decentralized digital currency system without the need for a trusted third party, like banks, central banks, or governments.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

a closer look at the mechanics and implementation of the Basel Framework indicates that cries for simplification may harbor deeper problems.

A popular argument for simplification purports that the intricacy of the Basel Framework results in detrimental effects, especially on small banks. The assumption is that only large and sophisticated entities have sufficient resources to fully implement articulated regulatory standards (Gurrea-Martínez and Remolina 2019). While more rigorous empirical studies to support such claims are needed, it must be noted immediately that the Basel Framework is grounded on a proportionality principle.[56] Accordingly, domestic authorities, while implementing the central tenets of the Basel Framework, may not implement the whole. A recent survey indicates that out of ninety jurisdictions, 85 percent apply the principle of proportionality, which consists of a simplified and standardized framework for calculating capital requirements (World Bank and Basel Committee on Banking Supervision 2021, 3). As a result, most banks (globally) are not required to comply with the most sophisticated parts of the Basel Framework, which was first introduced in 2004. Instead, capital requirements are commonly calculated following a classification of credit risk exposures introduced with the First Basel Accord (Basel I) of 1988 and often praised for its simplicity.[57] Critically, this version was very close to the one applied by SVB (and all other mid-sized banks), reflecting a deregulatory stance made in the name of simplicity.

The pursuit of simplification through law is, indeed, a complex matter. Conceptual and normative limitations affecting the understanding and governance of nonlinear dynamics may thwart financial stability objectives even when (relatively) simple legislations are implemented. Moreover, absent clear parameters, once simplification is elevated to a primary goal, regulatory policies will rely on subjective determinations of the level of complexity deemed acceptable. This is why pleas for simplification of regulatory standards mask, consciously or unwittingly, a deregulatory agenda.

A Risk Governance Perspective

Risk governance refers to a composite approach deployed to deal with risks that escape linear cause-and-effect relationships (Power 2007, 19; van Asselt and Renn 2011, 432). It embodies an organized structure where legal institutions, administrative discretion, and private and public actors are coherently coordinated to limit exposures, increase preparedness, and reduce the vulnerabilities of the social groups exposed to complex risks (Renn 2008, 5). Unlike financial regulation, which typically deploys different government-oriented models oscillating between command and control and

56. As a core principle for banking supervision, proportionality stipulates that domestic authorities should apply regulatory and supervisory standards on a "proportionate basis, taking into account the risk profile and systemic importance of banks." see Basel Framework, BCP01.33.

57. The Basel Committee on Banking Supervision adopted Basel I in 1988 and revised it in 1996. See International Convergence of Capital Measurement and Capital Standards. Basel I was then superseded by Basel II in 2004 and ultimately replaced by Basel III in 2011. Basel III and related amendments then converged within the current Basel Framework. In several jurisdictions, however, non-internationally active banks follow a simplified version of the current Basel Framework. In particular, they may adopt the standardized approach to calculate credit risk. Such an approach reflects some changes introduced with Basel II, but it is methodologically similar to the one advanced in Basel I (Castellano and Dubovec 2018b, 555–56).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

self-regulation (Castellano, Jeunemaître, and Lange 2012), a governance approach entails a combination of ordered rules (top-down) and collective actions (bottom-up) to achieve the desired goal (Stoker 1998, 18; Schweizer 2021, 83). By and large, risk governance encompasses a variety of measures intended to steer the decision-making processes of a network of public and private actors in consideration of broader behavioral, social, economic, and legal variables. Its core tenets are distilled in a set of principles issued by the International Risk Governance Council (2017), an independent organization based in Switzerland.

Central to risk governance is the recognition that societal factors add to the magnitude and complexity of disaster; therefore, adequate measures should be adopted. Unlike mainstream economic theory, which influences much of the regulatory policies for financial systemic risk, disaster risk governance is not anchored to the assumption that people react rationally to risks. Instead, it is acknowledged that risk is a subjective matter influenced by psychological, social, cultural, and political factors that determine idiosyncratic levels of tolerance.[58] If a risk is categorized as "intolerable," a prohibition is established to forbid any activity contributing to the risk under consideration. In contrast, if a risk is deemed "tolerable," appropriate measures to mitigate its negative impacts are implemented, whereas when a risk is considered "acceptable," risk mitigations are not necessary (International Risk Governance Council 2017, 20).[59] For disasters stemming from natural events that cannot be controlled, such as earthquakes and infectious diseases, tolerability and acceptability relate to the preventive measures that the population must deploy to reduce exposure to the risks arising from such hazards (Renn 2008, 144).

These general principles of risk governance are operationalized in the action plan developed by the international community to cope with disaster risk—the Sendai Framework. The Sendai Framework puts forward an "all hazards" approach premised on the following four priorities: furthering risk knowledge; reinforcing the institutional mechanisms to manage emergencies; stimulating investments to support disaster risk reduction efforts; and enhancing preparedness, recovery, and reconstruction *vis-à-vis* any form of danger.[60] While public institutions have the primary responsibility to meet these priorities, it is recognized that disaster risk reduction entails a whole-of-society approach, whereby various social actors contribute directly or indirectly to increase preparedness and resilience.

Upon these premises, disaster risk governance develops along four cyclical phases where only two states of reality exist: a disaster has already occurred or will occur. Prior to a disaster, once potential threats are identified, preventive measures are enacted to mitigate potential losses (mitigation and prevention phase), reduce vulnerabilities, and increase the preparedness of communities under threat (preparedness phase). Once a disaster occurs, actions are taken to contain the emergency (emergency response phase),

58. This point has been demonstrated by the literature on the cultural theory of risk, indicating that individuals and social groups have different views on what constitutes risk (Douglas and Wildavsky 1983).

59. In particular, Ortwin Renn (2008, 144) noted that "[t]o draw the line between 'intolerable' and 'tolerable' as well as 'tolerable' and 'acceptable' is one of the most difficult tasks of risk governance." This assessment is reflected in Principle 1 of the Sendai Framework, aimed at fostering the understanding of disaster risks within different local, domestic, and international contexts (14).

60. Sendai Framework, 14.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

facilitate reconstruction of damaged infrastructures, and promote the rehabilitation of the socio-economic order (recovery phase). The recovery phase ushers into the preparedness phase, thus setting the foundation for all risk governance activities. This is to say that reconstruction ought to occur to limit exposure to disaster risk by addressing existing vulnerabilities, as reflected in the "Build Back Better" principle, according to which mitigation and preparedness measures are implemented during the recovery phase.[61]

The Sendai Framework provides a general structure to develop more specific frameworks. While covering a diverse range of policy domains—from public health to hydrogeology—each risk governance framework shares a set of standard features underscored by the acknowledgment that social systems and systemic risks are complex phenomena. For instance, the *Pandemic Influenza Risk Management* guidance document entails a whole-of-society framework to ensure coordination between three key constituencies of stakeholders: public institutions, private businesses, and civil society (World Health Organization 2017). Each social group, in turn, is expected to contribute locally and internationally to the continuity of the activities in seven areas considered essential for the normal functioning of societies and identified as "health, defense, law and order, finance, transport, telecommunications, energy, food and water" (55). Finally, reflecting the cyclical occurrence of infectious diseases, governance actions are established depending on whether a pandemic has occurred or ought to occur.

Acknowledging that disaster risks are prone to subjective evaluations does not imply denying their measurability. On the contrary, it highlights the relevance of public perception for disaster risk reduction strategies. The predisposition to fear certain types of risks often pushes the public to take action and demand public interventions toward specific threats (Sunstein 2005, 100; Vogel 2012) while disregarding others (Michel-Kerjan and Slovic 2010). In this context, scientific evidence (where available) intersects with irrational images, as shown by the social stigma attached to the Black Death epidemic of the fourteenth century and the ongoing acquired immunodeficiency syndrome (AIDS) epidemic.[62] More recently, during the first wave of the COVID-19 pandemic, face masks—like other non-pharmaceutical precautionary measures—were implemented spontaneously by the populations of several Asian jurisdictions, such as Hong Kong and Taiwan (Chang and Chun-Yuan 2020, 49). Concomitantly, in the United States, the Centers for Disease Control and Prevention discouraged the use of face masks, and public authorities indicated that only those showing symptoms should wear masks in public.[63] As a result, at the outset of a global health emergency, the same preventative measure was concomitantly adopted by some and considered a sign of illness carrying a stigma by others. A governance framework aware of these dynamics should emphasize the need to implement effective communication strategies.[64]

61. Sendai Framework, 21.

62. At the outset of the acquired immunodeficiency syndrome epidemic, for instance, beliefs that the infections spread within certain social groups intensified racism and sexism. Twenty years later, it has been established that inequalities have been (and still are) at the root of the epidemic (Farmer 2001).

63. The use of face masks by the general public was considered ineffective and possibly dangerous (Cramer and Sheikh 2020).

64. Sendai Framework, 24.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

The approach deployed to govern financial systemic risk is remarkedly different. At the most fundamental level, it can be noted that there is no equivalent of a Sendai Framework for finance. Consequently, there is no general blueprint to guide actions and define responsibilities before, during, and after a financial crisis. Instead, a plethora of regimes have been enacted under the overarching umbrella of maintaining financial stability. For analytical purposes, these regimes can be roughly grouped into policies implemented before or after the failure of individual financial institutions (Cranston et al. 2018, 33). Accordingly, it can be noted that capital requirements and resolution plans are intended to perform a preventative function, ensuring that financial institutions are sufficiently capitalized to withstand a shock and have identified strategies for their orderly wind-up if needed; similarly, special insolvency and resolution regimes can be classified as emergency management frameworks that grant public authorities special stabilization powers to resolve troubled financial institutions while limiting contagion (Davis et al. 2023, 131). Arguably, it may also be noted that stress tests may perform a preventative role for financial institutions, whereas emergency liquidity lending and deposit insurance schemes can be intended to limit the impact of unfolding crises. These considerations, however, only reflect classificatory efforts. These instruments are not part of a cohesive governance framework and are not benchmarked against clearly enunciated prevention, preparedness, responsiveness, and recovery priorities. As a result, the management of system-wide threats largely depends on exceptional measures subject to discretionary choices and broader political swings. The CS case offers a vivid illustration of this point.

Confronted with the distress of CS and fearing material consequences for the stability of the financial system, the Swiss authorities departed from international and domestic rules to resolve systemically important financial institutions. Established in the aftermath of the GFC to address the "too-big-to-fail" problem, resolution regimes entail mechanisms to ensure the orderly resolution of troubled financial institutions while protecting depositors, ensuring that shareholders bear the losses first and avoiding the use of public funds (Financial Stability Board 2014). As the crisis precipitated, the Swiss government passed an emergency ordinance to expand the discretionary power of the Swiss regulator and resolution authority, allocate additional funds (to absorb potential losses and guarantee a private bailout), and change the hierarchy of priority rights under insolvency.[65] As a result, holders of convertible contingent bonds (CoCos)[66] were wiped out to absorb a loss of over eighteen billion dollars, shareholders received UBS shares worth $3.25 billion, and UBS received an additional liquidity line (equal to more than $110 billion) from the central bank, backed by a default guarantee to which the Swiss government also contributed (Paz Valbuena and Eidenmüller 2023, 3). These actions, albeit considered necessary, disattended established resolution plans and subverted the core principles for effective resolution of troubled financial institutions, two mainstays of the post-GFC regulatory reforms. Thus, it is evident that there is no rule-based plan to follow in times of crisis, let alone a governance structure organized in

65. See Additional Liquidity Ordinance of the Swiss Federal Council, March 16, 2023, amended on March 19, 2023.

66. Convertible contingent bonds (CoCos), or Additional Tier 1 capital (AT1) bonds, are a hybrid debt-instrument issued by banks to increase their total absorption capacity. In the event of distress, CoCos are written down or converted into equity.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

phases. The result is an uneven application of legal rules across time, sectors, and financial institutions.[67]

The lack of a structured framework is particularly evident in the context of post-crisis actions when recovery and reconstruction should occur. While disaster risk governance emphasizes the need to rebuild in preparation for the next disaster, regulatory reforms often attempt to restore a pre-crisis alleged normalcy. Generally invoked as the guiding principle of post-crisis policies, the Build Back Better principle is not a formalized concept to direct financial reforms. As a result, financial regulation is locked in a path-dependent dynamic that reiterates the same flawed approach to systemic risk. In the aftermath of financial distress, public discontent triggers a political reaction to reform extant laws. However, absent a general framework that ties preparedness to the identification and reduction of structural vulnerabilities, post-crisis reforms are more susceptible to deregulatory pressures and tend to be designed to address the specificities of past crises, leaving the financial system vulnerable to new forms of distress.

Toward a Governance Framework for Financial Systemic Risk

Breaking with the past, a governance framework for financial systemic risk provides a blueprint to handle the inherent complexities that give rise to financial instability. Premised on the notion that systemic risk and law are endogenous to finance, the proposed framework entails three core elements: (1) the enactment of regulatory regimes and supervisory actions that are calibrated to address specific priorities before, during, and after any crisis; (2) the establishment of a whole-of-society approach for crisis prevention, preparedness, response, and recovery; and (3) the implementation of structured communication policies. While an exhaustive treatise of all regulatory regimes contained in the proposed governance framework is a task necessarily left to future works, an analysis of these three core elements highlights the novelty of this approach, paving the way to more detailed studies.

The identification of different priorities for each phase of a crisis implies an acknowledgment that disturbances are reoccurring and, regardless of their origins, developing through cyclical patterns. Normatively, this means that the governance framework for financial systemic risk should institutionalize the notion that vulnerabilities accrue over time due to the nonlinear interactions both within the financial system—as epitomized by financial cycles of boom and bust—and between the financial system and its environment—when, for instance, financial distress is triggered by events not directly linked to financial activities. Hence, differently from a narrow understanding of vulnerabilities,[68] an all-hazard governance approach recognizes that financial instability comes in different forms and shifts the focus from the proximate causes of distress to the factors that impact a system's ability to limit their impact. Hence, taking as a point of reference the classifications adopted in the context of pandemic risk (World Health Organization 2017, 22), four periods are isolated:

67. This dynamic also corroborates Pistor's (2013, 320) observation on the "elasticity of law," defined as "the probability that *ex-ante* legal commitments will be relaxed or suspended in the future."

68. This is the case, for instance, of the definitions adopted by the International Monetary Fund, the Bank for International Settlements, and the Financial Stability Board (2009, 2016).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

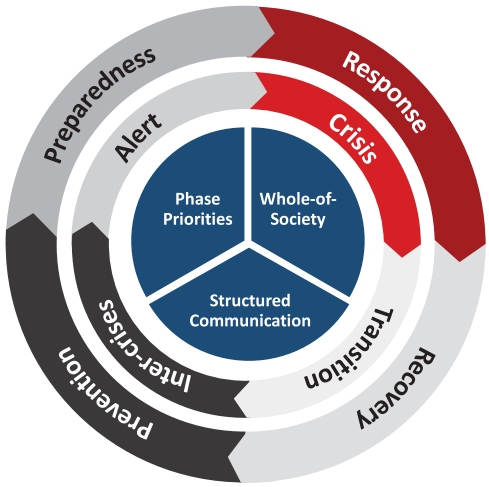

Figure 1.
Financial Systemic Risk Governance Framework: Core Elements, Crisis Phases, and Policy Priorities.

inter-crises, which are represented by the period in between financial crises; alert, which is when economic contractions, price volatility, diffused inability to service debt obligations, unanticipated shocks, or a combination of the above indicate that a crisis might occur; crisis, which is represented by an abnormal and diffused distress that, if left uncontrolled, can spread to the real economy; and transition, which is when the risk of contagion diminishes in anticipation of a new inter-crises period.

Following this rationale, rules are drafted, and supervisory decisions are taken to promote prevention, preparedness, crisis response, and recovery. Rather than relying solely on the general enunciation of protecting financial stability or reducing systemic risk, regulatory regimes and supervisory actions are geared to meet the priorities that each phase of a crisis dictates (Figure 1). During an inter-crises period, priority is given to the enactment of preventative measures; as alert signals manifest and disturbances escalate, the focus shifts toward preparedness and crisis response. Once a crisis has run its course, emergency actions are progressively rolled back to prioritize recovery. An illustration of how this approach can shape a holistic, yet flexible, framework for financial regulation is offered in the context of key prudential regimes enacted to prevent, prepare, and respond to different crisis scenarios.

During periods of relative stability, the implementation of preventative measures requires the identification of system-wide vulnerabilities. Regulators typically rely on a wide array of indicators to detect the buildup of risks. Most commonly, the growth rate of equity and property prices, the gap between the level of indebtedness and economic growth (credit gap), and the difference between the actual and potential production of a given economy (output gap) signal the emergence of distress (Borio and Lowe 2002; Chen and Svirydzenka 2021). Although these early warning signs identify the risks related to financial and economic cycles, primary attention should be given to the ability of the financial system to absorb different forms of losses. This means to recognize that financial cycles as well as non-financial events, such as geopolitical tensions and

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

climate change, may expose structural vulnerabilities. Hence, stress testing can be deployed to map structural fault lines that, under plausible circumstances, can trigger system-wide disruptions (Haldane, Hall, and Pezzini 2007, 5). However, as noted earlier, most stress test methodologies, such as those adopted by the Federal Reserve, cannot be used to perform a preventative function as they are not designed to identify system-wide fragilities. Following the logic of prevention, in fact, stress tests should serve as a diagnostic tool. For this purpose, they should be designed to identify the ability of the financial system or its part to absorb the costs related to different types of events. At the most fundamental level, the assessment of system-wide vulnerabilities requires gauging the availability of short-term funding and the mechanisms that may accelerate their depletion. Such an assessment should not be limited to individual financial institutions; it should also encompass a broader analysis that considers how liquidity shortages can spread owing to nonlinear dynamics and network effects, such as the feedback loops stemming from fire sales or from the failure of financial institutions.[69]

Once vulnerabilities are identified, measures are implemented to increase preparedness and, thus, ensure adequate responses to potential threats. Through this prism, correcting the procyclical effect of existing regulatory frameworks is a priority that can be addressed in different manners. A drastic solution is to require banks to maintain more effectively liquid assets (consisting of cash and prepositioned collateral to support the central bank's emergency lending) than liquid liabilities (comprising deposits and short-term unsecured debt). Advocated by Mervyn King (2016, 269), former governor of the Bank of England, this approach requires central banks to act as pawnbrokers, providing emergency lending based on pre-posted collateral; concomitantly, it binds banks' abilities to expand their balance sheets to the availability of liquid assets. This solution is gaining some traction in scholarly and policy circles since it would have prevented, among others, the failures of CS and SVB (Wolf 2023). However, its implementation would require a drastic change in the current business models for banking activities. An alternative approach to limit procyclicality is to detach, at least partially, capital adequacy standards from standardized risk weighting, which encourages herd behaviors, and devise additional buffers that are not linked to bank size, which leads to neglecting smaller entities. Instead, capital and liquidity cushions should be calibrated to address the vulnerabilities identified through early-warning indicators and (diagnostic) stress testing. For instance, regardless of the size of the bank, additional requirements can be progressively imposed on banks that are exposed to interest rate risks or supply chain disruptions.

The second element of the proposed governance framework entails the establishment of a whole-of-society strategy. Accordingly, responsibilities should be allocated in advance proportionately among market participants depending on the crisis phase. This proposition reveals again the limitations of existing regulatory regimes and indicates how to address them. Currently, systemically important financial institutions are required to submit recovery and resolution plans, detailing how they intend to

69. This understanding is in line with current proposals advocating for a more robust macroprudential approach to stress testing (Kress and Zhang, forthcoming, 26).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

ensure a rapid and orderly resolution in the event of distress or bankruptcy.[70] Such plans, however, were not required for SVB, which was exempted from enhanced supervisory requirements, and were disregarded in the CS case, as a private acquisition was preferred. Moreover, as they focus on the modes to wind up individual financial institutions, resolution plans neglect system-wide dynamics and remain silent on the role that entities should perform as crises unfold.

To ensure adequate crisis response, banks should have in place contingency plans similar to those deployed in the context of disasters. During disasters, private and public facilities, such as schools, universities, and corporations, are often repurposed according to predetermined criteria to limit the impact of the emergency. This technique, for instance, was adopted in the context of the COVID-19 pandemic. To avoid the collapse of the national health-care system, hospitals adopted triage schemes to prioritize urgent cases, whereas schools, clinics, and other buildings were deployed to meet the sudden surge of people in need of medical attention or to isolate contagion (Phua et al. 2020). Similarly, the role played by market participants to avert or limit system-wide disruptions should be predetermined. Contingency plans for financial institutions, in particular, should indicate what measures will be enacted to limit the propagation of a crisis. For example, banks should indicate how they intend to communicate with clients to maintain confidence, what additional sources of liquidity can be mobilized if a crisis materializes, and what type of support they can provide to connected entities in distress, such as key counterparties. This mechanism acknowledges that an effective response to systemic risk requires concerted actions where responsibilities (and costs) to mitigate system-wide disruptions are shared proportionally among market participants.

Finally, as a direct consequence of the whole-of-society approach, systemic risk governance entails the implementation of structured communication policies addressing information gaps throughout the crisis cycle. The ability of individuals to understand key economic information and make informed decisions about financial planning, wealth accumulation, pensions, and debt has material consequences for the stability of the financial system. Empirical studies indicate that the limited understanding of basic financial concepts, such as the effects of compound interests, inflation, and diversification on savings, is directly connected both to an excessive accumulation of debt in pre-crisis periods and to the inability to face unexpected economic difficulties during the height of a financial crisis (Lusardi and Mitchell 2014; 2023, 9). Similarly, high levels of financial literacy amongst depositors are inversely related to the probability of a bank run (Campioni et al. 2017), while constituencies with low financial literacy are more likely to default on their mortgages (Gerardi, Goette, and Meier 2013) or liquidate their assets once they have lost value (Bucher-Koenen and Ziegelmeyer 2014). Given that the stability of the financial system is intrinsically linked to the decisions made at the individual level, a fundamental priority for systemic risk governance is to reduce the vulnerabilities connected to financial illiteracy. This implies going beyond current consumer protection regimes and educating the public at large about financial stability.

70. See Dodd-Frank Act, s. 165(d) and I-Annex 4 of the *Key Attributes of Effective Resolution Regimes for Financial Institutions* (Financial Stability Board 2014).

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Recent financial crises have spurred efforts to protect people from financial exploitation due to limited knowledge. In the United States, for instance, the Dodd-Frank Act established the Consumer Financial Protection Bureau (CFPB), an independent agency housed in the Federal Reserve, with a broad range of rule-making, supervisory, and enforcement powers to protect consumers and help them to make better financial decisions by promoting financial education.[71] The CFPB's role is in line with the proposed holistic approach as it monitors system-wide dynamics in view of the needs of different constituencies, attempting to reach any individual interacting with the financial system. Building upon this structure, the lesson from disasters indicates, in fact, that it is imperative for individuals to comprehend the impact of their actions on broader financial dynamics and possess sufficient knowledge to respond appropriately before, during, and after a period of distress. To this end, efforts to bolster financial literacy should be paired with a clear communication strategy to inform the public about each phase of a crisis—the CFPB, in coordination with the Federal Reserve, can perform this task. Clear communication indicating that an expanding economy is in fact in an inter-crisis period can be a powerful tool to enhance public awareness about potential risks and, thus, incentivize preventative actions.

CONCLUSION

A quote attributed to a nineteenth-century Swiss historian, Jacob Burckhardt, presciently cautioned that "the denial of complexity is the essence of tyranny."[72] Reducing intricate, multifaceted issues to simplistic, often dogmatic, viewpoints consolidates a dominant narrative to explain and address them. The same can be argued in the context of financial regulation. Rules designed, implemented, and enforced on the basis of simplified assumptions reflect the persistence of an ideology that reflects the neoliberal credo to limit public interventions in private markets. Beyond this ideological and political dimension, this article shows that any regulatory interventions based on a reductionist view of complex dynamics are unequipped to promote financial stability. Through this prism, neglecting complexity is not only intellectually flawed but also politically dangerous and socially irresponsible. Put differently, a regulatory framework that treats financial instability as an anomaly disconnected from the decisions of market participants (a market failure) is equivalent to treating every catastrophe as an "act of God," exonerating social actors from any responsibility to limit their occurrence or impact.

Complexity, however, should not be considered a problem to solve or a residual effect to be curtailed in order to promote financial stability. From living organisms to elaborate societal structures, complexity signals the vibrancy and dynamism essential for adaptability and growth. In finance, attempts to control complexity often flag confusion between "complexity" and merely "complication"—in fact, the former is intrinsic, and only the latter can be reduced. More commonly, the pursuit of simplification hides a deregulatory agenda and reiterates a reductionist view. Building on Ulrich Beck's (1999, 31) insights, modernity

71. See 12 U.S.C. §5491–99.
72. Giorgio Parisi (2023, 14) referred to it in his Nobel Prize lecture.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

engenders fundamental risks that cannot be addressed with the same methods devised by early industrial societies. A paradigm shift is thus needed.

This article has charted the contours of such a shift and identified its main elements. The parallel between financial and non-financial systemic risk, anchored to a shared notion of complexity, has proven to offer critical insights and reliable methodological foundations. While exposing the inadequacies of current approaches and limiting implicit reliance on (and reiteration of) common reductionist logics, it has set the premises for a new governance framework for financial systemic risk. Crucially, this understanding paves the way for new scholarly and policy analyses to devise and implement a cohesive set of regulatory regimes that strengthen the resilience of the financial system through inclusive and transparent policy actions. As finance permeates daily life and is interlocked with the most pressing issues of our times—from climate change and escalating inequalities to geopolitical shifts—ensuring its robustness bears profound socioeconomic ramifications.

REFERENCES

Aristotle. 1989. *Metaphysics*. Translated by Hugh Tredennick. Vols. 17, 18. Cambridge, MA: Harvard University Press.

Acharya, Viral V, Lasse Pedersen, Thomas Philippon, and Matthew Richardson. 2013. "Measuring and Regulating Systemic Risk." In *Handbook on Systemic Risk*, edited by Jean-Pierre Fouque and Joseph A Langsam, 226–46. Cambridge, UK: Cambridge University Press.

Admati, Anat, and Martin Hellwig. 2013. *Bankers' New Clothes*. Princeton, NJ: Princeton University Press.

Adrian, Tobias, and Hyun Song Shin. 2010. "The Changing Nature of Financial Intermediation and the Financial Crisis of 2007–2009." *Annual Review of Economics* 2, no. 1: 603–18.

Aikman, David, Mirta Galesic, Gerd Gigerenzer, Sujit Kapadia, Konstantinos Katsikopoulos, Amit Kothiyal, Emma Murphy, and Tobias Neumann. 2021. "Taking Uncertainty Seriously: Simplicity versus Complexity in Financial Regulation." *Industrial and Corporate Change* 30, no. 2: 317–45.

Alemanno, Alberto. 2016. "Risk and Regulation." In *Routledge Handbook of Risk Studies*, edited by A. Burgess, A. Alemanno, J. Zinn, 191–203. New York: Routledge.

——. 2020. "The European Response to COVID-19: From Regulatory Emulation to Regulatory Coordination?" *European Journal of Risk Regulation* 11, no. 2: 307–16.

Allen, Hilary J. 2015. "Putting the 'Financial Stability' in Financial Stability Oversight Council." *Ohio State Law Journal* 76, no. 5: 1088–1152.

Alligood, Kathleen T., Tim D. Sauer, and James A. Yorke. 1996. *Chaos*. New York: Springer.

American International Group. 2008. *Annual Report (Form 10-K)*. February 28.

Anisimov, Ariadna, and Alexander Magnan, eds. 2023. *The Global Transboundary Climate Risk Report*. Paris: Institute for Sustainable Development and International Relations and Adaptation without Borders.

Armour, John, Dan Awrey, Paul Davies, Luca Enriques, Jeffrey N. Gordon, Colin Mayer, and Jennifer Payne. 2016. *Principles of Financial Regulation*. Oxford: Oxford University Press.

Arner, Douglas W., Giuliano G. Castellano, and Eriks Selga. 2023. "Financial Data Governance." *Hastings Law Journal* 74, no. 2: 235–92.

Arrow, Kenneth J., and Gerard Debreu. 1954. "Existence of an Equilibrium for a Competitive Economy." *Econometrica* 22, no. 3: 265–90.

Arthur, W. Brian. 1999. "Complexity and the Economy." *Science* 284, no. 5411: 107–9.

——. 2015. *Complexity and the Economy*. New York: Oxford University Press.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Avgouleas, Emilios. 2015. "Regulating Financial Innovation." In *The Oxford Handbook of Financial Regulation*, edited by N. Moloney, E. Ferran, and J. Payne, 659–92. Oxford: Oxford University Press.

Awrey, Dan. 2012. "Complexity, Innovation, and the Regulation of Modern Financial Markets." *Harvard Business Law Review* 2 no. 2: 235–94.

Awrey, Dan, and Kathryn Judge. 2020. "Why Financial Regulation Keeps Falling Short." *Boston College Law Review* 61, no. 7: 2295–2353.

Bailey, Kenneth D. 1994. *Sociology and the New Systems Theory: Toward a Theoretical Synthesis*. New York: State University of New York Press.

Baily, Martin N., Justin Schardin, and Phillip L. Swagel. 2016. *Did Policymakers Get Post-Crisis Financial Regulation Right?* Washington, DC: Bipartisan Policy Center.

Baker, Andrew. 2010. "Restraining Regulatory Capture? Anglo-America, Crisis Politics and Trajectories of Change in Global Financial Governance." *International Affairs* 86, no. 3: 647–63.

Baldwin, Robert, and Julia Black. 2008. "Really Responsive Regulation." *Modern Law Review* 71, no. 1: 59–94.

Baldwin, Robert, Martin Cave, and Martin Lodge. 2012. *Understanding Regulation: Theory, Strategy, and Practice*. 2nd ed. Oxford: Oxford University Press.

Balkin, Jack M. 1986. "The Crystalline Structure of Legal Thought." *Rutgers Law Review* 39: 1–110.

—— 1990. "Promise of Legal Semiotics." *Texas Law Review* 69: 1831–52.

Barrow-Green, June. 1997. *Poincaré and the Three Body Problem*. Providence, RI: American Mathematical Society.

Bator, Francis M. 1958. "The Anatomy of Market Failure." *Quarterly Journal of Economics* 72, no. 3: 351–79.

Beck, Ulrich. 1999. *World Risk Society*. Cambridge, UK: Polity Press.

Bernanke, Ben S. 2016. "Ending 'Too Big to Fail': What's the Right Approach?" *Brookings Institution*, May 13. https://www.brookings.edu/articles/ending-too-big-to-fail-whats-the-right-approach/.

Bertalanffy, Ludwig von. 1950. "An Outline of General System Theory." *British Journal of the Philosophy of Science* 10: 134–65.

Black, Julia. 2012. "Paradoxes and Failures: 'New Governance' Techniques and the Financial Crisis." *Modern Law Review* 75, no. 6: 1037–63.

——. 2013. "Reconceiving Financial Markets: From the Economic to the Social." *Journal of Corporate Law Studies* 13, no. 2: 401–42.

——. 2014. "Learning from Regulatory Disasters." Law, Society and Economy Working Papers no. 24/2014.

Borio, Claudio. 2003. "Towards a Macroprudential Framework for Financial Supervision and Regulation?" *CESifo Economic Studies* 49, no. 2: 181–215.

Borio, Claudio E. V., and Philip William Lowe. 2002. "Asset Prices, Financial and Monetary Stability: Exploring the Nexus." BIS Working Paper no. 114.

Born, Brooksley. 2011. "Deregulation: A Major Cause of the Financial Crisis." *Harvard Law and Policy Review* 5: 231–44.

Braithwaite, Joanne P. 2014. "Law after Lehmans." Law, Society and Economy Working Papers no. 11/2014.

Bridge, Michael, and Joanne P. Braithwaite. 2013. "Private Law and Financial Crises." *Journal of Corporate Law Studies* 13, no. 2: 361–99.

Buchanan, James M., and W. Craig Stubblebine. 1962. "Externality." *Economica* 29, no. 116: 371–84.

Bucher-Koenen, Tabea, and Michael Ziegelmeyer. 2014. "Once Burned, Twice Shy? Financial Literacy and Wealth Losses during the Financial Crisis." *Review of Finance* 18, no. 6: 2215–46.

Buckley, Ross P., Douglas W. Arner, Dirk A. Zetzsche, Anton N. Didenko, and Lucien J. Van Romburg. 2021. "Sovereign Digital Currencies: Reshaping the Design of Money and Payments Systems." *Journal of Payments Strategy and Systems* 15, no. 1: 7–22.

Campioni, Eloisa, Vittorio Larocca, Loredana Mirra, and Luca Panaccione. 2017. "Financial Literacy and Bank Runs: An Experimental Analysis." *CEIS Working Paper* no. 402 15.

Capra, Fritjof. 1997. *Web of Life*. London: Flamingo.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Castellano, Giuliano G. 2010. "Governing Ignorance: Emerging Catastrophic Risks-Industry Responses and Policy Frictions." *Geneva Papers on Risk and Insurance: Issues and Practice* 35, no. 3: 391–415.

Castellano, Giuliano G., Douglas Arner, and Eriks Selga. 2023. "The Emergence of Financial Data Governance and the Challenge of Financial Data Sovereignty." In *Data Sovereignty: From the Digital Silk Road to the Return of the State*, edited by A. Chander and H. Sun, 178–210. New York: Oxford University Press.

Castellano, Giuliano G., and Marek Dubovec. 2018a. "Credit Creation: Reconciling Legal and Regulatory Incentives." *Law and Contemporary Problems* 81, no. 1: 63–85.

——. 2018b. "Global Regulatory Standards and Secured Transactions Law Reforms: At the Crossroad between Access to Credit and Financial Stability." *Fordham International Law Journal* 41, no. 1: 531–88.

Castellano, Giuliano G., and Geneviève Helleringer. 2019. "The Social Psychology of Financial Regulatory Governance." In *The Political Economy of Financial Regulation*, edited by Emilios Avgouleas and David C. Donald, 160–88. Cambridge, UK: Cambridge University Press.

Castellano, Giuliano G., Alain Jeunemaître, and Bettina Lange. 2012. "Reforming European Union Financial Regulation: Thinking through Governance Models." *European Business Law Review* 23, no.3: 409–46.

Castellano, Giuliano G., and Andrea Tosato. 2021. "Commercial Law Intersections." *Hastings Law Journal* 72, no. 4: 999–1054.

Chang, Wen-Chen, and Lin Chun-Yuan. 2020. "Taiwan: Democracy, Technology, and Society." In *COVID-19 in Asia: Law and Policy Contexts*, edited by Victor V. Ramraj, 43–56. Oxford: Oxford University Press.

Chen, Benjamin Minhao, Alexander Stremitzer, and Kevin Tobia. 2022. "Having Your Day in Robot Court." *Harvard Journal of Law and Technology* 36, no. 1: 127–69.

Chen, Sally, and Katsiaryna Svirydzenka. 2021. "Financial Cycles: Early Warning Indicators of Banking Crises?" IMF Working Papers 2021 no. 116.

Cilliers, Paul. 1998. *Complexity and Post-Modernism: Understanding Complex Systems*. London: Routledge.

Coase, Ronald H. 1937. "The Nature of the Firm." *Economica* 4, no. 16: 386–405.

—— 1960. "The Problem of Social Cost." *Journal of Law and Economics* 3: 1–44.

Coffee, John C. Jr. 2012. "Political Economy of Dodd-Frank: Why Financial Reform Tends to Be Frustrated and Systemic Risk Perpetuated." *Cornell Law Review* 97, no. 5: 1019–82.

Comte, Auguste. 1875. *System of Positive Polity*. Vol. 2. Paris: Longmans, Green and Company.

Conti-Brown, Peter, and Brian D. Feinstein. 2021. "The Contingent Origins of Financial Legislation." *Washington University Law Review* 99, no. 1: 145–222.

Cramer, Maria, and Knvul Sheikh. 2020. "Surgeon General Urges the Public to Stop Buying Face Masks." *New York Times*, February 29.

Cranston, Ross, Emilios Avgouleas, Kristin van Zwieten, Christopher Hare, and Theodor van Sante. 2018. *Principles of Banking Law*. 3rd ed. Oxford: Oxford University Press.

Crockett, Andrew D. 2000. "Marrying the Micro- and Macro-prudential Dimensions of Financial Stability." Paper presented at Eleventh International Conference of Banking Supervisors, Basel, September 20–21.

Cunningham, Lawrence A. 1993. "From Random Walks to Chaotic Crashes: The Linear Genealogy of the Efficient Capital Market Hypothesis." *George Washington Law Review* 62, no. 4: 546–608.

Dahlman, Carl J. 1979. "The Problem of Externality." *Journal of Law and Economics* 22, no. 1: 141–62.

Danielsson, Jon. 2008. "Blame the Models." *Journal of Financial Stability* 4, no. 4: 321–28.

Danielsson, Jon, and Hyun Song Shin. 2003. "Endogenous Risk." In *Modern Risk Management: A History*, edited by Peter Field, 297–316. London: Risk Books.

Danielsson, Jon, Marcela Valenzuela, and Ilknur Zer. 2023. "The Impact of Risk Cycles on Business Cycles: A Historical View." *Review of Financial Studies* 36, no. 7: 2922–61.

Davis, Ronald, Stephan Madaus, Monica Marcucci, Irit Mevorach, Riz Mokal, Barbara Romaine, Janis Sarra, and Ignacio Tirado. 2023. *Financial Institutions in Distress: Recovery, Resolution, and Recognition*. Oxford: Oxford University Press.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Davis, Gerald F., and Suntae Kim. 2015. "Financialization of the Economy." *Annual Review of Sociology* 41, no. 1: 203–21.

Deakin, Simon, David Gindis, Geoffrey M. Hodgson, Kainan Huang, and Katharina Pistor. 2017. "Legal Institutionalism: Capitalism and the Constitutive Role of Law." *Journal of Comparative Economics* 45, no. 1: 188–200.

Dell'Erba, Marco. 2019. "Stablecoins in Cryptoeconomics from Initial Coin Offerings to Central Bank Digital Currencies." *New York University Journal of Legislation and Public Policy* 22, no. 1: 1–48.

Department of the Treasury, Federal Reserve, and Federal Deposit Insurance Corporation. 2023. *Joint Statement*. Doc. FDIC: PR-17-2023, March 17.

Diamond, Douglas W, and Philip H. Dybvig. 1983. "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91, no. 3: 401–19.

Douglas, Mary, and Aaron Wildavsky. 1983. *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers*. Berkeley: University of California Press.

Edelman, Lauren B., Christopher Uggen, and Howard S. Erlanger. 1999. "The Endogeneity of Legal Regulation: Grievance Procedures as Rational Myth." *American Journal of Sociology* 105, no. 2: 406–54.

Enriques, Luca, Alessandro Romano, and Thom Wetzer. 2019. "Network-Sensitive Financial Regulation." *Journal of Corporation Law* 45, no. 2: 351–98.

Epstein, Joshua M., Jon Parker, Derek Cummings, and Ross A. Hammond. 2008. "Coupled Contagion Dynamics of Fear and Disease: Mathematical and Computational Explorations." *PLoS One* 3, no. 12: e3955.

Fama, Eugene F. 1965. "The Behavior of Stock-Market Prices." *Journal of Business* 38, no. 1: 34–105.

—— 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Finance* 25, no. 2: 383–417.

Farber, Daniel A, Jim Chen, Robert R. M. Verchick, and Lisa Grow Sun. 2015. *Disaster Law and Policy*. 3rd ed. New York: Aspen Publisher.

Farmer, Paul. 2001. *Infections and Inequalities: The Modern Plagues*. Berkeley: University of California Press.

Federal Reserve. 2023. *Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank*. Washington, DC: Board of Governors of the Federal Reserve System.

Financial Stability Board. 2010. *Reducing the Moral Hazard Posed by Systemically Important Financial Institutions*. Basel: Bank for International Settlements.

——. 2014. *Key Attributes of Effective Resolution Regimes for Financial Institutions*. Basel: Bank for International Settlements.

——. 2023. *Global Regulatory Framework for Crypto-Asset Activities*. Basel: Bank for International Settlements.

Fisher, Elizabeth, Eloise Scotford, and Emily Barritt. 2017. "The Legally Disruptive Nature of Climate Change." *Modern Law Review* 80, no. 2: 173–201.

Fleischer, Victor. 2010. "Regulatory Arbitrage." *Texas Law Review* 89, no. 2: 227–89.

Funabashi, Yoichi, and Kay Kitazawa. 2012. "Fukushima in Review: A Complex Disaster, a Disastrous Response." *Bulletin of the Atomic Scientists* 68, no. 2: 9–21.

Georgosouli, Andromachi. 2010. "Regulatory Interpretation: Conversational or Constructive?" *Oxford Journal of Legal Studies* 30, no. 2: 361–84.

Gerardi, Kristopher, Lorenz Goette, and Stephan Meier. 2013. "Numerical Ability Predicts Mortgage Default." *Proceedings of the National Academy of Sciences* 110, no. 28: 11267–71.

Gerding, Erik. 2016. "The Dialectics of Bank Capital: Regulation and Regulatory Capital Arbitrage." *Washburn Law Journal* 55, no. 2: 357–84.

Giddens, Anthony. 1990. *The Consequences of Modernity*. Cambridge, UK: Polity.

Gilad, Sharon. 2014. "Beyond Endogeneity: How Firms and Regulators Co-Construct the Meaning of Regulation." *Law & Policy* 36, no. 2: 134–64.

Goldin, Ian, and Mike Mariathasan. 2014. *The Butterfly Defect*. Princeton, NJ: Princeton University Press.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Gurrea-Martínez, Aurelio, and Nydia Remolina. 2019. "The Dark Side of Implementing Basel Capital Requirements: Theory, Evidence, and Policy." *Journal of International Economic Law* 22, no. 1: 125–52.

Haites, Erik. 2018. "Carbon Taxes and Greenhouse Gas Emissions Trading Systems: What Have We Learned?" *Climate Policy* 18, no. 8: 955–66.

Haldane, Andrew G., and Robert M. May. 2011. "Systemic Risk in Banking Ecosystems." *Nature* 469, no. 7330: 351–55.

Haldane, Andrew, Simon Hall, and Silvia Pezzini. 2007. "A New Approach to Assessing Risks to Financial Stability." *Bank of England Financial Stability Paper* 2: 3–45.

Harvey, David. 2007. "Neoliberalism as Creative Destruction." *Annals of the American Academy of Political and Social Science* 610, no. 1: 22–44.

Heyvaert, Veerle. 2022. "Governing Intersystemic Systemic Risks: Lessons from COVID and Climate Change." *Modern Law Review* 85, no. 4: 938–67.

Hofmann, Christian. 2011. "Central Bank Collateral and the Lehman Collapse." *Capital Markets Law Journal* 6, no. 4: 456–69.

Hood, Christopher, Henry Rothstein, and Robert Baldwin. 2001. *The Government of Risk: Understanding Risk Regulation Regimes*. Oxford: Oxford University Press.

Hutter, Bridget M. 2006. "Risk, Regulation, and Management." In *Risk in Social Science*, edited by Peter Taylor-Gooby and Jens O. Zinn, 202–27. Oxford: Oxford University Press.

International Monetary Fund, Bank for International Settlements, and Financial Stability Board. 2009. *Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations. Report to the G-20 Finance Ministers and Central Bank Governors*. Basel: Bank for International Settlements.

—— 2016. *Elements of Effective Macroprudential Policies. Lessons from International Experience*. Basel: Bank for International Settlements.

International Risk Governance Council. 2017. "Introduction to the IRGC Risk Governance Framework." https://irgc.org/risk-governance/irgc-risk-governance-framework/.

International Federation of Red Cross and Red Crescent Societies. N.d. "What Is a Disaster?" https://www.ifrc.org/our-work/disasters-climate-and-crises/what-disaster.

Ip, Eric C. 2023. "An Emergent Planetary Health Law." *International and Comparative Law Quarterly* 72, no. 4: 1047–67.

Jackson, Howell. 2022. "A Meeting of Minds on Central Bank Digital Currencies for the United States." *Harvard National Security Journal* 14, no. 1: 67–74.

Jones, David. 2000. "Emerging Problems with the Basel Capital Accord: Regulatory Capital Arbitrage and Related Issues." *Journal of Banking and Finance* 24: 35–58.

Judge, Kathryn. 2012. "Fragmentation Nodes: A Study in Financial Innovation, Complexity, and Systemic Risk." *Stanford Law Review* 64, no. 3: 657–725.

Kauffman, Stuart A., 1993. *The Origins of Order: Self-Organization and Selection in Evolution*. Oxford: Oxford University Press.

Kaufman, George G., and Kenneth E Scott. 2003. "What Is Systemic Risk, and Do Bank Regulators Retard or Contribute to It?" *Independent Review* 7, no. 3: 371–91.

King, Mervyn., 2016. *The End of Alchemy: Money, Banking, and the Future of the Global Economy*. New York: W. W. Norton & Company.

Krawiec, Kimberly D. 2019. "Let's Talk: What FinReg Can Learn from New Governance (and Vice Versa)." *Law & Social Inquiry* 44, no. 4: 1241–50.

Kress, Jeremy C., Patricia A. McCoy, and Daniel Schwarcz. 2019. "Regulating Entities and Activities: Complementary Approaches to Nonbank Systemic Risk." *Southern California Law Review* 92, no. 6: 1455–1528.

Kress, Jeremy C., and Jeffery Zhang. Forthcoming. The Macroprudential Myth." *Georgetown Law Journal*. https://ssrn.com/abstract=4530708.

Krippner, Greta R. 2005. "The Financialization of the American Economy." *Socio-Economic Review* 3, no. 2: 173–208.

Kucharski, Adam. 2020. *The Rules of Contagion: Why Things Spread—and Why They Stop*, London: Profile Books.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Lastra, Rosa M. 2015. "Systemic Risk and Macro-Prudential Supervision." In *The Oxford Handbook of Financial Regulation*, edited by N. Moloney, E. Ferran, and J. Payne, 309–33. Oxford: Oxford University Press.

Lee, Emily. 2012. "Investor Protection in Lehman Brothers' Insolvency Litigation." *Journal of Comparative Law* 7: 284–306.

Levine, Aaron M., and Joshua C. Macey. 2018. "Dodd-Frank Is a Pigouvian Regulation." *Yale Law Journal* 127, no. 5: 1336–1415.

Lin, Tom C. W. 2013. "The New Investor." *UCLA Law Review* 60: 678–735.

Lorenz, Edward N. 1963. "Deterministic Nonperiodic Flow." *Journal of Atmospheric Sciences* 20, no. 2: 130–41.

Luhmann, Niklas. 1995. *Social Systems*. Translated by John Bednarz. Stanford, CA: Stanford University Press.

——. 2014. *A Sociological Theory of Law*. Edited by Martin Albrow. 2nd ed. London: Routledge.

Lusardi, Annamaria, and Olivia S. Mitchell. 2014. "The Economic Importance of Financial Literacy: Theory and Evidence." *Journal of Economic Literature* 52, no. 1: 5–44.

——. 2023. "The Importance of Financial Literacy: Opening a New Field." NBER Working Paper no. 31145.

MacKenzie, Donald. 2023. *Trading at the Speed of Light: How Ultrafast Algorithms Are Transforming Financial Markets*. Princeton, NJ: Princeton University Press.

Magnan, Alexandre K., Ariadna Anisimov, and Virginie K. E. Duvat. 2022. "Strengthen Climate Adaptation Research Globally." *Science* 376, no. 6600: 1398–1400.

Masciandaro, Donato, and Francesco Passarelli. 2013. "Financial Systemic Risk: Taxation or Regulation?" *Journal of Banking and Finance* 37, no. 2: 587–96.

May, Robert M. 1972. "Will a Large Complex System Be Stable?" *Nature* 238, no. 5364: 413–14.

McKenzie, Lionel W. 1959. "On the Existence of General Equilibrium for a Competitive Market." *Econometrica* 27, no. 1: 54–71.

Merton, Robert C., and Zvi Bodie. 1995. "A Conceptual Framework for Analyzing the Financial Environment." In *The Global Financial System: A Functional Perspective*, edited by Dwight B. Crane, Kenneth A. Froot, Andre F. Perold, Robert C. Merton, and Peter Tufano, 3–31. Boston: Harvard Business School Press.

Metcalf, Gilbert E. 2009. "Designing a Carbon Tax to Reduce U.S. Greenhouse Gas Emissions." *Review of Environmental Economics and Policy* 3, no. 1: 63–83.

Michel-Kerjan, Erwann, and Paul Slovic. 2010. *The Irrational Economist: Making Decisions in a Dangerous World*. New York: Public Affairs.

Mill, John Stuart. 1869. *On Liberty*. London: Longmans, Green, Reader, and Dyer.

Minsky, Hyman P. 2015. *Can "It" Happen Again?: Essays on Instability and Finance*. New York: Routledge.

Moloney, Niamh. 2012. "Financial Services and Markets." In *The Oxford Handbook of Regulation*, edited by Robert Baldwin, Martin Cave, and Martin Lodge, 437–61. Oxford: Oxford University Press.

——. 2023. *EU Securities and Financial Markets Regulation*. 4th ed. Oxford: Oxford University Press.

Monti, Alberto. 2009. "Climate Change and Weather-Related Disasters: What Role for Insurance, Reinsurance and Financial Sectors." *Hastings West-Northwest Journal of Environmental Law and Policy* 15, no. 1: 151–72.

Munich Re. 2024. *Natural Disasters in 2023*. Munich: Munich Re.

Nakamoto, Satoshi. 2008. "Bitcoin: A Peer-to-Peer Electronic Cash System." *Bitcoin.org*. http://bitcoin.org/bitcoin.pdf.

North, Douglass C. 1990. *Institutions, Institutional Change, and Economic Performance: The Political Economy of Institutions and Decisions*. Cambridge, UK: Cambridge University Press.

New York State Department of Financial Services. 2023. *Internal Review of the Supervision and Closure of Signature Bank*. New York: New York State Department of Financial Services.

Omarova, Saule T. 2020. "Technology v Technocracy: Fintech as a Regulatory Challenge." *Journal of Financial Regulation* 6, no. 1: 75–124.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Organisation for Economic Co-operation and Development. 2003. *Emerging Systemic Risks in the 21st Century: An Agenda for Action*. Paris: Organisation for Economic Co-operation and Development Publishing.
Palmer, T. N. 2009. "Edward Norton Lorenz. 23 May 1917—16 April 2008." *Biographical Memoirs of Fellows of the Royal Society* 55: 139–55.
Parisi, Giorgio. 2023. "Nobel Lecture: Multiple Equilibria." *Reviews of Modern Physics* 95, no. 3: 1–18.
Parsons, Talcott. 1951. *The Social System*. London: Routledge & Kegan Paul.
Paz Valbuena, Javier, and Horst Eidenmüller. 2023. "Bailout Blues: The Write-Down of the AT1 Bonds in the Credit Suisse Bailout." ECGI Working Paper Series in Law no. 705.
Perrow, Charles. 1984. *Normal Accidents: Living with High Risk Technologies*. Princeton, NJ: Princeton University Press.
——. 2011. "Fukushima and the Inevitability of Accidents." *Bulletin of the Atomic Scientists* 67, no. 1: 44–52.
Phua, Jason, Li Weng, Lowell Ling, Moritoki Egi, Chae-Man Lim, Jigeeshu Vasishtha Divatia, Babu Raja Shrestha et al. 2020. "Intensive Care Management of Coronavirus Disease 2019 (COVID-19): Challenges and Recommendations." *The Lancet Respiratory Medicine* 8, no. 5: 506–17.
Pigou, Arthur Cecil. 2013. *The Economics of Welfare*. New York: Palgrave Macmillan.
Pistor, Katharina. 2013. "A Legal Theory of Finance." *Journal of Comparative Economics* 41, no. 2: 315–30.
Poledna, Sebastian, Elena Rovenskaya, Ulf Dieckmann, Stefan Hochrainer-Stigler, and Igor Linkov. 2020. "Systemic Risk Emerging from Interconnections: The Case of Financial Systems." In *Systemic Thinking for Policy Making*, edited by William Hynes, Martin Lees, and Jan Marco Müller, 123–31. New Approaches to Economic Challenges. Paris: Organisation for Economic Co-operation and Development.
Post, David G., and Michael B. Eisen. 2000. "How Long Is the Coastline of the Law? Thoughts on the Fractal Nature of Legal Systems." *Journal of Legal Studies* 29: 545–84.
Power, Michael. 2007. *Organized Uncertainty: Designing a World of Risk Management*. Oxford: Oxford University Press.
Renn, Ortwin. 2008. *Risk Governance: Coping with Uncertainty in a Complex World*. London: Earthscan.
Renn, Ortwin, Manfred Laubichler, Klaus Lucas, Wolfgang Kröger, Jochen Schanze, Roland W. Scholz, and Pia-Johanna Schweizer. 2022. "Systemic Risks from Different Perspectives." *Risk Analysis* 42, no. 9: 1902–20.
Riles, Annelise. 2011. *Collateral Knowledge*. Chicago: University of Chicago Press.
Roe, Mark J., and Michael Troge. 2018. "Containing Systemic Risk by Taxing Banks Properly." *Yale Journal on Regulation* 35, no. 1: 181–232.
Romano, Roberta. 2014. "For Diversity in the International Regulation of Financial Institutions: Critiquing and Recalibrating the Basel Architecture." *Yale Journal on Regulation* 31, no. 1: 1–77.
Royal Swedish Academy of Sciences. 2021. "The Nobel Prize in Physics 2021." Press release, October 5. https://www.nobelprize.org/prizes/physics/2021/press-release/.
Sawyer, R. Keith. 2005. *Social Emergence: Societies as Complex Systems*. Cambridge, UK: Cambridge University Press.
Schumpeter, Joseph A. 1947. *Capitalism, Socialism and Democracy*. New York: Routledge.
Schwarcz, Steven L. 2008. "Systemic Risk." *Georgetown Law Journal* 97, no. 1: 193–249.
—— 2009. "Regulating Complexity in Financial Markets." *Washington University Law Review* 87, no. 2: 211–68.
—— 2019. "Systematic Regulation of Systemic Risk." *Wisconsin Law Review* 2019, no. 1: 1–54.
Schweizer, Pia-Johanna. 2021. "Systemic Risks: Concepts and Challenges for Risk Governance." *Journal of Risk Research* 24, no. 1: 78–93.
Scott, Hal S. 2010. "The Reduction of Systemic Risk in the United States Financial System." *Harvard Journal of Law and Public Policy* 33, no. 2: 671–734.
—— 2016. *Connectedness and Contagion: Protecting the Financial System from Panics*. Cambridge, MA: MIT Press.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press

Shiller, Robert J. 1989. *Market Volatility*. Cambridge, MA: MIT Press.
—— 2008. *The Subprime Solution: How Today's Global Financial Crisis Happened, and What to Do About It*. Princeton, NJ: Princeton University Press.
Shleifer, Andrei, and Robert Vishny. 2011. "Fire Sales in Finance and Macroeconomics." *Journal of Economic Perspectives* 25, no. 1: 29–48.
Singh, Dalvinder. 2020. *European Cross-Border Banking and Banking Supervision*. Oxford: Oxford University Press.
Slovic, Paul. 1999. "Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield." *Risk Analysis* 19, no. 4: 689–701.
Smith, Adam. 1902. *The Wealth of Nations*. New York: Collier.
Snider, Laureen. 2011. "The Conundrum of Financial Regulation: Origins, Controversies, and Prospects." *Annual Review of Law and Social Science* 7, no. 1: 121–37.
——. 2020. "Beyond Trump: Neoliberal Capitalism and the Abolition of Corporate Crime." *Journal of White Collar and Corporate Crime* 1, no. 2: 86–94.
Sornette, Didier. 2017. *Why Stock Markets Crash*. Princeton, NJ: Princeton University Press.
Stiglitz, Joseph. 2015. *The Great Divide*. New York: Penguin Books.
Stoker, Gerry. 1998. "Governance as Theory: Five Propositions." *International Social Science Journal* 50, no. 155: 17–28.
Stone Sweet, Alec. 1999. "Judicialization and the Construction of Governance." *Comparative Political Studies* 32, no. 2: 147–84.
Sunstein, Cass R. 2005. "Precautions against What: The Availability Heuristic and Cross-Cultural Risk Perception." *Alabama Law Review* 57: 75–101.
Swiss National Bank. 2023. *Financial Stability Report*. Zurich: Swiss National Bank.
Tarullo, Daniel K. 2008. *Banking on Basel: The Future of International Financial Regulation*. Washington, DC: Peterson Institute.
Teubner, Gunther. 1988. *Autopoietic Law: A New Approach to Law and Society*. Berlin: Walter de Gruyter.
Thaler, Richard H., and Cass R. Sunstein. 2021. *Nudge*. New Haven, CT: Yale University Press.
Thurner, Stefan, Rudolf Hanel, and Peter Klimek. 2018. *Introduction to the Theory of Complex Systems*. Oxford: Oxford University Press.
Tierney, James Fallows. 2022. "Investment Games." *Duke Law Journal* 72, no. 2: 353–446.
United Nations. 2016. *Report of the Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction*. UN Doc. A/71/644, December 1.
Urry, John. 2005. "The Complexities of the Global." *Theory, Culture & Society* 22, no. 5: 235–54.
Utset, Manuel A. 2011. "Complex Financial Institutions and Systemic Risk." *Georgia Law Review* 45, no. 3: 779–840.
Van Asselt, Marjolein B. A., and Ortwin Renn. 2011. "Risk Governance." *Journal of Risk Research* 14, no. 4: 431–49.
Van der Zwan, Natascha. 2014. "Making Sense of Financialization." *Socio-Economic Review* 12, no. 1: 99–129.
Varela, Francisco G, Humberto R Maturana, and Ricardo Uribe. 1974. "Autopoiesis: The Organization of Living Systems, Its Characterization and a Model." *Biosystems* 5, no. 4: 187–96.
Vogel, David., 2012. *The Politics of Precaution*. Princeton, NJ: Princeton University Press.
Whalen, Ryan. 2022. "Defining Legal Technology and Its Implications." *International Journal of Law and Information Technology* 30, no. 1: 47–67.
Wolfe, Nathan D., Claire Panosian Dunavan, and Jared Diamond. 2007. "Origins of Major Human Infectious Diseases." *Nature* 447, no. 7142: 279–83.
World Bank and Basel Committee on Banking Supervision. 2021. "Proportionality in Bank Regulation and Supervision – A Joint Global Survey." Basel: Bank for International Settlements.
Wolf, Martin. 2023. "Four Ways to Fix the Bank Problem." *Financial Times*, 21 March.
World Health Organization. 2017. *Pandemic Influenza Risk Management*. Doc. WHO/WHE/IHM/GIP/2017.1. Geneva: World Health Organization.

https://doi.org/10.1017/lsi.2024.8 Published online by Cambridge University Press