



RISK AND COMPLEXITY

Global integration and new technology mean rapid progress—but also higher risk

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Today's integration of economic systems and increased flow of ideas expands our choice, broadens our horizons, and is a catalyst for creativity, innovation, and growth. But it also dramatically changes the nature of risk.

The integration of complex systems leads to unintended and sometimes unknown consequences. The pace of change means that economies now face significant new challenges for which national and international governance systems are poorly prepared.

One of these risks is growing complexity—in global air travel, cross-border financial investments, and Internet infrastructure. Economic development and the integration of economies amplify this complexity by raising the volume of traffic that flows across these many and diverse connections and by adding new nodes—cities, industrial zones, ports, computer network or logistics hubs, power stations, labs, conferences, and journals. While global integration through economies of scale and harmonization of consumer preferences or global rules and regulations (such as those

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of the World Trade Organization) may reduce complexity, the fragmentation of supply chains, proliferation of rules, and growth in the number of participants and governments overwhelm the potential for simplification.

Complexity can be a good thing. The greater variety and volume of connections and flows provide a springboard for accelerating innovation and have produced a more dynamic and distributed global economy. It also creates resilience. The diversification of global growth has lifted and produced more stable global growth. Increasing trade integration may lead to higher business cycle synchronization between advanced and emerging market economies. However, the growing diversification of emerging markets away from advanced economies and the growth of trade between emerging markets build resilience. So too does the development of their domestic markets and regulatory and supervisory capacity. Systems design and competition and other regulations can contribute to resilience in complex systems. Beyond finance, this can ensure,

prolonged aftermath. Dozens of books and hundreds of articles in esteemed academic journals have been written about the causes of the financial crisis. The competing interpretations of the causes reflect the growing difficulty of identifying cause and effect in complex systems.

Although each of the new financial activities, such as derivative instruments or currency swaps, may have been designed to distribute and thereby reduce risk, no one actor in the financial crisis had a clear view of their systemic implications. Part of the reason is that national regulators were managing systems that transcend national borders. But even within countries regulators lacked a clear picture of the activities. The exponential growth of computing power provided the platform for the integration of radically new capabilities into finance, such as credit derivatives. These risks were not understood by the audit committees and regulators, reflecting generational and skill mismatches in rapidly evolving systems. Institutions and regulations advance slowly, while technologies and their application in

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for example, that if one link on the Internet goes down, its traffic reroutes to alternatives. Similarly, when one ATM goes down, another can be tapped, provided the alternatives are served by independent companies or operating systems.

But growing complexity poses a severe challenge for risk management. The more complicated our interactions become, the harder it is for us to see relationships of cause and effect. We develop cognitive blind spots in our vision of the events around us. How can we make good decisions when we can't foresee the consequences? More complex systems also provide more scope for interdependent relationships, some of which may only become visible when it is too late. Where correlated risks rise, each individual element or economy in the system has a greater risk exposure, and this can magnify the impact of any economic or other risk if it materializes.

Who's to blame?

The problem of attribution was learned the hard way from the 2007–08 financial crisis and its

complex systems change much faster. Cumulative connective and developmental forces produced a global financial system that was suddenly far bigger and more complex than just a decade before. This made the new hazards harder to see and simultaneously spread the dangers more widely—to workers, pensioners, and companies worldwide.

In retrospect, the dangers of rising complexity were obvious. The balance sheets of countries, institutions, and individual investors and borrowers became more heavily leveraged and more interconnected. Financial instruments became more complex, largely thanks to the introduction of progressively more powerful computers into the portfolio-building process. Like a pandemic pathogen, toxic debts originated in the small backwater of subprime mortgage lending and spread quickly through intertwined balance sheets to threaten the global financial system.

The financial sector's tangled complexity muddled the vision of those standing in its midst. Few private or public sector actors perceived the accumulating danger. As author Michael Lewis



observed in a Bloomberg column in 2008, “[The CEO of Bear Stearns] plays bridge, and [the CEO of Merrill Lynch] golfs while their firms collapse, not because they don’t care their firms are collapsing, but because they don’t know that their firms are collapsing.” And although the IMF signaled its concern regarding the growing risks, in its April 2007 *Global Financial Stability Report*, it concluded that “weakness has been contained to certain portions of the subprime market . . . and is not likely to pose a serious systemic risk. Stress tests conducted by investment banks show that . . . most investors

traditional risk silos. When contemplating future risk to the financial system, we must be acutely aware that a pandemic in a major financial hub or a cyberattack or extreme climate event is at least as likely to be the source of the next financial crisis as a repetition of the factors that led to the 2007–08 crisis. The old linear risks have not gone away, and fire, theft, reputation, critical personnel loss, and other traditional risks can still destroy companies. But it is the systemic risks that arise from the growing entanglement of firms, economies, and systems that are escalating most rapidly. With finance providing the lifeblood of our new interdependencies, the management of systemic risk in finance is more important than ever.

Concentration’s risks

A key element of systemic risk is the evolution of nodes and networks in which certain nodes become dominant in the integrated system. Whether these are logistics centers, cities, airport hubs, cyberhubs, or financial centers, more and more global traffic is flowing through increasingly concentrated geographic areas. Concentration tends to reflect the benefits of economies of scale

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with exposure to subprime mortgages through securitized structures will not face losses.”

At the national level, central banks, regulators, and treasuries are among the strongest government institutions, with among the best people, data, and analytic capability and in many countries a clear mandate for financial stability. At the international level, the same is true for the IMF and the Bank for International Settlements. The fact that all these institutions were largely blindsided by the financial crisis speaks to the rapid evolution of a new type of risk in the 21st century—systemic risk.

In this age of globalization we need to move from linear concepts of risk to understand systemic risk. This means seeing the big picture when all of the elements of a system are placed side by side, such as the cumulative and consolidated balance sheets of financial institutions. It also means that we need to think across the

and no doubt brings significant benefits and efficiencies. Whereas the focus of competition policy has been on the size of institutions, in a world of systemic risk the geographic concentration of critical systems or nodes of infrastructure and people is of significance. Individual geographic centers are vulnerable to a host of potentially catastrophic events, including pandemics, weather (for example, a Hurricane Katrina or Sandy), terrorism, infrastructure (for example, cyber or energy outages), and other risks. The more any global activity is concentrated geographically, the more vulnerable the global system integrated with the center to risks of a location-specific shock.

Rising concentration makes failures in the financial system more likely to occur. Leading up to the financial crisis, concentration was increasing at every level. At the firm level, capital and resources were concentrated in the new securitized

mortgage and debt products. At the turn of the century, these products were niche offerings; by the outbreak of the crisis, they had become the second-largest class of asset-backed securities sold in the United States each year. Subprime mortgages were the first.

Industry concentration was also on the rise. In the United States between 1990 and 2008, the market share of the top three banks quadrupled from 10 percent to 40 percent. In the United Kingdom in 2008, the top three banks owned 80 percent of the market (up from 50 percent in 1997). The phrase “too big to fail” entered public discourse to describe these organizations. Their executives knew their respective governments would never let them go bust—the ensuing chaos would be too great. Their investment discipline weakened—a phenomenon economists aptly call moral hazard. The biggest financial institutions began to take excessive risks, knowing that should things go seriously awry, taxpayers would bail them out. And, indeed, they did.

Concentration also rose at the level of whole economies, as booming financial sectors loomed ever larger in the total economic mix. In the United Kingdom, between 1990 and the start of the crisis, the size of the financial sector grew from less than 6 percent to almost 10 percent of total GDP, and to over one-fifth of London’s economic output.

The adoption of uniform mark-to-market accounting—accounting for the fair value of an asset or liability based on current market pricing—and regulatory standards around the world brings benefits but also carries hidden risks. In the run-up to the financial crisis a growing number of jurisdictions had deregulated their domestic finance industries, facilitating the rapid adoption of credit derivative and other instruments, which greatly increased financial leverage. The explosive growth of these instruments was associated with the development of what Andrew Haldane, then executive director for financial stability and now chief economist at the Bank of England, described as a “monoculture” that “became, like plants, animals and oceans before it, less disease-resistant.”

Each of these concentrations posed a genuine dilemma. Each one asked us to trade off legitimate private goals against poorly understood public dangers. What politician could afford to go against the deregulatory trend, when capital seemed so mobile and loosening credit made voters feel so good?

What financial firm could afford to stay out of a new market when those entering it were profiting so highly? What person would not be tempted by the prospect of buying a house with little or no money down and building equity just by watching its value grow? All of which raises the question: Who, then, was to blame?

The financial crisis showed how difficult these dilemmas can be, especially when politicians and CEOs are motivated by short-term cycles in which the incentives are stacked against enduring pain to build longer-term resilience and growth. Even if the risk of collapse had been more widely understood, it’s not clear that politicians would have acted to prevent it.

Globalization requires cooperation

Over the past 30 years, the global integration of markets and more rapid flow of ideas around the world have led to the most rapid progress in the history of humanity. However, the unprecedented advances also carry new risks, including those arising from growing inequality and the spillovers of success, such as climate change, antibiotic resistance, and other environmental and social dislocations. Further risks arise from revolutionary new technologies and growing complexity.

The solutions are to be found not in the retreat from globalization, but in closer cooperation to meet our shared challenges. In finance, globalization—despite its benefits—can bring about concentration risks. Due to the pace of innovation in finance, there also is a constant need for reskilling in both the private and public sectors. This calls for more vigilance on the part of regulators and supervisors and, as firms become more integrated, closer cooperation of policymakers. Growing integration brings rising interdependency.

Have we learned our lesson? Or will history repeat itself—again? [FD](#)

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