Opinion: A new approach to financial regulation

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It has been five years since the US Congress enacted the landmark Dodd–Frank Wall Street Reform and Consumer Protection Act; and despite the fact that about 20% of the Act has yet to be implemented (1), several legislative initiatives are now attempting to soften or roll back key provisions. This pattern of regulatory action and reaction is not new. The financial excesses of one period often lead to asset bubbles that burst, ushering in a new period of much greater regulation. This, in turn, is systematically weakened over time as markets recover and we forget the reasons why we imposed such stringent regulations in the first place. Even before Dodd–Frank, the financial industry was among the most highly regulated of industries in the world. However, the many layers of regulation and multiple regulatory agencies were insufficient to prevent financial crisis. Why?

We propose that the financial system has crossed a threshold of complexity where the system is evolving faster than regulators and regulations can keep pace. For example, the system is now truly globally connected, but coordination across sovereign jurisdictions is difficult to achieve. This new situation calls for a new perspective, one based on a different paradigm than the ones on which financial regulation is currently based, such as efficient markets, rational expectations, and models patterned after the physical sciences.

The challenge of complexity is not unique to finance but applies as well to other human endeavors, including the management of environmental systems, international relations, cyberterrorism, and bioterrorism. In some cases, this challenge has been met successfully by implementing perspectives and methods from evolutionary biology, game theory, and complex systems theory, in partnership with domain experts in each field of application.

These ideas have generally not been applied to financial regulation, despite a National Research Council report on systemic risk that was cosponsored by the Federal Reserve Bank of New York and the National Academy of Sciences to encourage such partnerships (2), and sympathetic perspectives by prominent regulatory insiders (3, 4). Evolutionary principles have, of course, been applied to many economic contexts, but they have had little impact to date on financial regulation. Here, we advocate changing the regulatory ecosystem by proposing collaboration among experts in various disciplines and professions.

Biological systems have faced a range of challenges throughout evolutionary history, and this has led to solutions that are adaptive, hierarchical, modular, and with sufficient redundancy to minimize the chances of collapse. We can learn a great deal from biological systems in designing new regulatory frameworks for financial systems, which face similar challenges. We do not

Our financial system is arguably on shaky ground. Could principles from biology and ecology inspire better ways to maintain stability? Image courtesy of Dave Cutler.

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yet, however, know how to do so except in a small fraction of cases.

Therefore, we propose an interdisciplinary research agenda that will apply principles learned from how evolution has built biological systems to financial regulation. We have only the broad outlines of such an approach today; hence, the call for new research. However, as proof of principle, we provide a few concrete examples of specific insights that evolutionary biology and ecology can offer to current financial regulatory challenges: (*i*) too big to fail, (*ii*) adaptive regulation, (*iii*) homeostatic mechanisms, and (*iv*) robustness and resiliency.

Too big to fail: The physical size of an organism is determined by a combination of environmental, physiological, and evolutionary factors that can be measured and predicted. Analogous to cancer, uncontrolled growth can then be understood as some alteration or disruption of these factors. Moreover, just as cancers are difficult to combat because they are not foreign invaders but part of our own bodies, large financial institutions play vital roles in our economy. A biological approach to understanding the growth of banks may offer a more permanent solution to the too-big-to-fail problem, which has become even more problematic after the 2008 Financial Crisis; remarkably, the largest banks are even larger and more interconnected today than in 2007 (5). It was that interconnectedness that sowed the seeds for the crash of 2008–2009 (6), and hence remains a cause for concern (3).

Adaptive regulation: The vertebrate immune system evolved to address the certainty of unpredictable assaults on the body. It involves a combination of surveillance, recognition of invasion, rapid generalized responses, adaptive longer-term responses, and memory. Financial regulation lacks many of these components as part of a well-developed system of protocols, but they are needed. We believe we can build such features into regulation, and we provide a specific proposal: allow regulatory leverage restrictions to adapt to time-varying risk levels of an institution's assets as well as the level of aggregate risk in the macroeconomy.

Homeostatic mechanisms: Regulatory feedback loops in nature involve activation and inhibition acting on compatible time scales. When this symmetry is broken, as for example when the regulatory mechanism is delayed in its implementation, potential fatal pathologies, like Cheyne–Stokes breathing (rapid cycles of hyperventilation and apnea) may result. Similarly, financial innovation, sometimes augmented by government policy, can lead to cancer-like unchecked growth of components of the system, threatening the stability of the entire system. The solutions must involve either more adaptive regulatory mechanisms that can keep up with financial innovation or the imposition of frictions to slow growth (e.g., leverage limits, transaction taxes, licensing, and registration hurdles).

Robustness and resiliency: Perhaps the most important consequence of the Financial Crisis of 2008 is the new realization that the current financial system is not robust; threats to financial stability can arise from surprising quarters. We propose applying the notion of ecosystem robustness, which is characterized by four properties—redundancy and degeneracy, diversity and heterogeneity, modularity, and tightness of feedback loops (7)—to financial regulation. These concepts imply that current regulatory oversight is inadequate, and current efforts to centralize regulatory authority could actually contribute to financial instability.

We can learn a great deal from biological systems in designing new regulatory frameworks for financial systems.

These examples are not meant merely as analogies to financial contexts. Rather, they are biologically equivalent contexts in which evolution has produced successful mechanisms to specific challenges to stability and survival through competition, innovation, and natural selection. The economy is, after all, the product of the machinations, institutions, and interactions of individuals from one particular animal species, *Homo sapiens*. The unique abilities of our species—abstract thought, forward-looking and planning behavior, and social interactions, including sophisticated communication, computation, and large-scale cooperation—imply that the interactions are particularly subtle and complex. Nevertheless, they are still the product of animal behavior and the sooner we acknowledge this fact of nature, the sooner we can explore novel approaches to improving financial regulation.

The language and tools of biology—especially ecology and evolutionary biology—are ideally suited for analyzing the trade-off between exploration and exploitation. This is not a simple optimization problem because of the adaptation that economic agents undergo in response to the changing conditions they create, something economists have been keenly aware of since Robert Lucas (8) critiqued Keynesian macroeconomic policy for ignoring the fact that rational economic agents can anticipate policy changes and respond optimally. However, these so-called dynamic stochastic general-equilibrium models have been of limited utility in guiding regulators toward specific policy recommendations to manage this balance (9, 10).

A biological perspective neatly addresses the Lucas critique (8): both the regulators and the regulated are part of a much larger financial ecosystem. Their strategies evolve together, as a result of the changes in the financial environment they themselves create. This approach implies that the influence of regulators and the regulated on one another, and the feedback loops they face, must also be included in policy decisions.

Unless we approach the financial system as an ecosystem when adopting, revising, implementing, and evaluating regulations, we are unlikely to achieve our twin objectives of sustained economic growth and financial stability, just as Lucas (8) warned nearly 40 years ago. Our hope is to motivate financial regulators, economists, ecologists, evolutionary biologists, and complex systems theorists to collaborate on developing a new paradigm for regulating the financial system because the current paradigm is not sufficient. Where there has been success in other systems, it has come from the active engagement and interaction of multiple stakeholders, each contributing unique expertise to develop a more complete and integrated approach to systems management. Historically, regulators have not been engaged in such research, but the experience of 2008 has made clear just how crucial and beneficial this new approach could be.

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