

## 20. The Policy Conundrum of Financial Market Complexity

Hilton L. Root  
George Mason University

“Your own best footstep may unleash the very cascade that carries you away, and neither you nor anyone else can predict which grain will unleash the tiny or the cataclysmic alteration.”

—Stuart Kauffman

*The Origins of Order: Self-Organization and Selection in Evolution*

(Kauffman 1993)

**Abstract:** The first global financial sector crash eludes conventional assessments of sector risk. Singling out the usual culprits—the housing bubble, executive pay, regulators, rating agencies, risk models, and global imbalances—fails to explain either the unpredictability or the rapidity of the collapse of 2008, which in many ways resembled the avalanche of a sand pile, where at some point of criticality, avalanches occur that bear no relationship to the grain of sand that triggered them. Since appropriate financial regulation is part of the remedy, policymakers should recognize that success will depend on a more refined knowledge of why some initial events may have prompted an avalanche, while others did not.

## I. ECONOMICS AND THE SAND PILE

A pile of sand. What could be a less likely metaphor for a global financial system that contains close to \$200 trillion in assets worldwide? Yet an avalanche in that sand pile caused a colossal financial meltdown that destroyed at least 15 percent of national wealth in the United States alone.<sup>1</sup> Which grain of sand triggered the avalanche? We cannot know with certainty where it was or why it moved. Conventional risk models used by economists are poor at predicting which set or category of transactions pushed the markets into a system-wide free fall, and they fail completely at expressing the market in collapse.

Because financial instruments such as mortgages, bonds, and derivatives operate in several markets at the same time, they are subject not only to the internal dynamics inherent in those particular markets, but to interactive risks as well, emanating from the wider financial system. In fact, the trading of those financial instruments might have originated the interactive risks—they reflect correlations across activities and markets when losses in one area affect losses in another. The solutions are much harder to find than when a discrete sector or market is affected.

The operative rule for policymakers who resort to social science is that one must know the cause of a problem in order to ensure against it. But that standard methodology was not effectual for the experts who sought the grain of sand in the aftermath of the

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<sup>1</sup>The loss in U.S. household wealth between December 2007 and December 2008 was 17 percent; because both stocks and homes are widely held, the losses were spread among the population. By the end of 2008, the Dow Jones Industrial Average was down 34 percent compared to a year earlier.

2008 financial collapse. The system's international internal dynamics are not observable by today's mathematical models, which had grown obsolete long before the collapse itself. Nonetheless, the policymakers in charge of the cleanup have resorted to boilerplate platitudes in their immediate response to the crisis, calling for increased regulation or insisting that the markets would sort themselves. Both responses oversimplify the nature of the collapse.

## **II. THE OPEN ARCHITECTURE OF THE FINANCIAL SYSTEM**

The giant crash came after a decade of smaller financial collapses around the world, in Russia, East Asia, Brazil, and in the United States. Each of these smaller collapses occurred in an equally sudden fashion and without an explicit precipitating event, and all occurred with great rapidity as the impacts crossed from one financial sector to another, with amplifying, system-level effects.

From that pattern of persistent and intermittent crises, one might have assumed that given enough time, one might witness the inevitability of a rare massive avalanche. Yet when it did come in 2008, it arrived just as unexpectedly and just as fast as the smaller ones before it. The world watched, transfixed and stunned. Until then, it had been presumed that the system's decentralized architecture and its responsiveness to price signals would enable it to absorb major shocks, and that the many supervisors and watchdogs engaged in oversight would take note of systemic risk long in advance of actual danger. The assumptions were false.

Yet none of the potential weaknesses, if measured in proportion to the size of the system itself, seemed large enough to threaten the entire system. So when the massive avalanche finally did occur, the professionals expected to find a cause that was just as massive. Even the collapse of the housing market's subprime sector, however, was not large enough by itself to cause the overall systemic collapse.

In each of the previous smaller meltdowns the size of the precipitating event, discernable after the fact was unrelated to the magnitude of the outcome—just as the size of the avalanche is unrelated to the grain of sand that triggered it. “The same tiny grain of sand may unleash a tiny avalanche or the largest avalanche of the century,” explains Stuart Kauffman. “Big and little events can be triggered by the same kind of tiny cause. Poised systems need no massive mover to move massively” (Kauffman 1993:236). In 2008, the gurus of the financial system—thinking in terms of efficient market theory, equilibrium conditions, and random walks—did not foresee that large events could have small causes or that both small and large crashes could be triggered by small events.

### **III. THE DEMOCRATIZATION OF HIGH YIELD, A NEW COMPLEXITY, AND THE GLOBAL FINANCIAL CRISIS**

Where does the complexity come from that made the global financial crisis so intractable? Why did instability suddenly arrive, like a “phase transition,” similar to the way ice melts to liquid? Why were market participants unable to observe what they thought would be predictable milestones of system criticality? The financial system is itself a partial regime, comprising multiple systems of order that function simultaneously.

A lesson drawn by evolutionary ecologists dealing with a parallel analytical problem -- cross scale effects – is that when what happens at one scale is affected by events at other scales, optimization models are likely to fail. Socio-ecological systems cannot be understood by studying only one scale because linkages across scales will determine how the system as a whole operates.<sup>2</sup>

Beginning in the 1970s the financial system was given responsibility for being an agent of social change when financial institutions were ordered to classify and issue loans according to the social identity of the recipient. Political leaders of modern democracies, not only in the United States, sought to allow their populations to access high yield financial services, once a privilege known only to elite consumers. Financial policy was politically designated to be a tool of social inclusiveness that would be less deleterious for the economy and less controversial politically than outright redistribution. Social stability could be strengthened if ordinary workers could be the beneficiaries of high-yield, high-volatility capitalism.

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<sup>2</sup> In a highly influential contribution to the study of environment and ecology Simon Levin argues that “the problem of pattern and scale is the central problem in ecology” (Levin 1992:1943). The regularities of the biosphere derive from interacting self-organizing processes rather than being parts of a unified or centralized whole (Levin 2009:772). The structure and dynamics of one scale of a social-ecological system will depend on the dynamics of the system at scales above and below. For example social and political risks that are not effectively managed will prevent economic transitions to market-based resource distribution. A state is similar to an ecological system being composed of a hierarchy of interconnected adaptive cycles that operate at multiple scales. Complexity exists because any one scale is linked to hierarchies that govern system wide behavior. Economists are generally inclined to models that ignore the multi-scale structure of the economy. Ignoring cross scale dynamics that are inevitable in economic systems cause failures to optimize adaptive evolution.

The decision to pursue democratic access to high yield as a vehicle of social inclusion was compatible with the social agendas of both US political parties: no one should be excluded from the benefits of high-achieving capitalism. Engaging wider sectors in capital accumulation was much more palatable than redistributing wealth and it was something with which all politicians could agree. However, the democratization of high-yield financial capitalism ended the financial certainty upon which measures of risk were traditionally calculated, adding sociopolitical risk to ordinary business risk, altering the underlying logic of financial sector risk.

The crisis that began in 2008 derives its complexity from the mixing of a social agenda with the market calculus of risk. Overlooked was the fact that financial markets not only create wealth—they also liquidate wealth. Thus *democratic capitalism* exposed much wider segments of the population to the gains, as well as disturbances, of a financial system that remains delicately balanced on the edge of chaos. To avoid repeating the adverse consequences that contributed to the crisis it is critical to understand that the democratizing of high-yield capital was a source of systemic risk and uncertainty. But it was a policy that was pursued in earnest beginning in the 1990s and therefore is not the grain of sand that precipitated the collapse.<sup>3</sup>

#### **IV. BEHAVIORIAL ECONOMICS CAN OFFER CLUES TO THE MARKET'S INTERNAL DYNAMICS**

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<sup>3</sup> The antecedents of the policy can be found in the Community Reinvestment Act of 1979.

Dissenting voices in economics have offered critical insights that modify the assumptions of the efficient market theory, the idealized view in which all the relevant information is already in today's prices, that each price change is independent of the last, and that yesterday's change will not influence today's price. The crisis of 2008 has taught us that the global financial system is a dynamic, open system that reacts most sensitively to its own internal dynamics.

Behavioral economics offers some useful insights into those dynamics, for instance, that bubbles and crashes are inherent to markets because the behaviors of the market participants generate their own sets of dynamics. What happens today does influence tomorrow's decisions. When one country invades another or refuses to abide by a treaty, potential partners will remember that refusal, which will shape their perceptions of its commitments for years, if not decades. Market participants are no different; they too have long memories. The stories they tell and the beliefs they hold about the behavior of others matter as much as do statistical probabilities. The behaviorist models demonstrate that market agents are less strategic and more emotional than traditional models anticipate (Shermer 2007).<sup>4</sup>

The conventional models that presumed to transform risk into a deterministic, reversible process underestimated long-term interdependence. Historical evidence suggests that markets are not as self-contained as the models presume. It is unrealistic to assume the interchangeability of the future and the past. The reality is that prices cluster and January is traditionally bullish not because fundamentals of the global economy shift but because investors believe that other market participants routinely experience

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<sup>4</sup> For a popular overview of behavioral economics see Michael Shermer (Shermer 2007) or Richard Thaler and Cass Sunstein (Thaler and Sunstein 2008).

optimism at year opening. Participants have memories of past actions that condition how they read signals about the future as a result price shifts do not exhibit statistical independence, nor are they normally distributed.

In a paper published in 1988, Vernon Smith et al. tested the assumption that if only experienced traders participated in the market, bubbles would be smaller and less frequent (Smith, Suchanek, & Williams 1988). They concluded that professionals are no better at steering the market toward normalcy than are uninformed novices. The study revealed that professional traders are not as economically rational as the efficient price theories presume. They are not quicker to learn, and they are no less likely than amateur traders to have irrational expectations. Such behavior causes price bubbles to be an empirical regularity of markets.

Questions about the internal dynamics of the market have never been at the top of the research agenda in finance. Why do traders speak of market “optimism” and “pessimism”? Do market participants trade on rumors and gossip, fears and expectations? Are markets self-propelling systems, or are they driven in large part by what investors believe about what other investors believe? Keynes compared traders to judges at a beauty pageant. Rather than selecting the faces they like best, they select the ones they believe are most likely to please the other judges.

The failure of one investor to cover a position is not supposed to spread throughout the system. And in conventional risk models, it takes only a minimal number of rational players to drive the market toward efficiency. But in real markets, when traders with vastly different expectations and goals fail to anticipate each other’s actions, the outcomes are volatile. Volatility occurs because market participants lack common

expectations. They come together with different time horizons; some may react with more immediacy than others. Information may not be immediately absorbed, which creates a dynamic that is different from the sum of its parts. Such internally generated time inconsistencies can have the same effect on prices as has the revelation of externally generated information that economists do pay attention to, such as the weakening of the labor market or a slowdown in capital expenditures. Conventional approaches, rooted as they are in an equilibrium framework, overemphasize exogenous shocks and disregard the system's self-generated internal dynamics.

## **V. RAPIDITY AND UNPREDICTABILITY**

The financial crisis of 2008 has been explained as a story of ingenuous and shortsighted manipulation by the few against a poorly informed and gullible public. Alternatively, it is told as a tragedy of technocratic hubris and overreach by a crew of high-octane computational models from the hard sciences (Lohr 2008). Arcane computations based on formidable mathematical models allowed a handful of professors to earn Wall Street salaries.

Only a few summers before the crash of 2008, economists and practitioners alike, the financial-sector experts, had touted system stability as an issue forever solved. That confidence in the fundamental soundness of the system was born from the success in dealing with the 1997 collapse of the Asian economies,<sup>5</sup> which regained their vigor in a few short years. Russia's markets collapsed in 1998, only to recover and usher in a

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<sup>5</sup> Between 1997 and 1998, Thailand, Indonesia, and South Korea all suffered depletion of the current account, and depreciation and decline in real output.

decade of unprecedented growth. They had helped Brazil's markets revive after current account deficits led to a crash in 1998–1999. They had even averted a global recession despite the collapse of Long Term Capital Management (LTCM) in 1999, and the dotcoms in 2001, which had destroyed \$5 trillion dollars in assets. But in 2008, Iceland's economy and banking system collapsed, and though the experts didn't know it then, Iceland marked the beginning of system-wide failure. It was an avalanche, but not the grain of sand—not the cause of what followed.

The crash in the fall of 2008 is an anomaly to those who seek statistical regularity; unexpected and inexplicable to those closest to it. It was the culmination of a chain of events, no doubt, but not attributable to a single cause. In retrospect it is easy to identify accumulated excesses spanning a long period of time and to note that, yes, some industry models anticipated specific bubbles. (Many commentators within the real estate sector, for example, anticipated the burst in the U.S. housing bubble.) But while we can identify the components of instability, hindsight will not help us identify that point when the system reached criticality. We do not yet fully understand the system's hard-to-discern internal dynamics, and thus we also cannot know which particular dynamic(s) contained sufficient risk to cause the system to experience an avalanche. The systemic risk only makes its appearance in the form of a collapse. The financial innovations of the seventies and eighties possessed their own internal dynamics that contributed to the system's criticality, but those sequences and linkages did not reveal themselves until after the crisis happened.

Alarmingly, financial systems replicate the behavior of other out-of-equilibrium, complex systems, such as the weather, “where minor disturbances may lead to events,

called avalanches, of all sizes” (Bak 1999). A single random twitch can cause components in a complex system to disintegrate; and the links across such open systems can dramatically amplify the impact system-wide. Even a complete description of the vibrations within one component of the system will not provide an adequate understanding of how the impact is transferred across other components. Complex systems are known to self-organize into instability against all foresight and precaution.

Most conventional models of financial systems assume operational equilibrium. The market may actually seem stable until the very moment when it goes into a free fall—and then the models that described the market in its pre-crisis state lose their effectiveness at describing the state of crisis into which the market has succumbed. Most conventional models also have trouble coping with two of the most recurrent features of financial system volatility: the remarkable rapidity and unpredictability of meltdown. The conventional tools endorsed by the international financial community can rarely detect an imminent collapse. The East Asian economies collapsed only several weeks after an IMF team gave the Thai and South Korean economies clean bills of health. Similarly, in the months before the collapse of the U.S. financial system, the IMF issued a positive prognosis for global economic growth, expecting a quick recovery from a minor recession. Bear Stearns collapsed just days after its creditors on the overnight market refused to extend credit the firm needed to cover positions it had taken during the trading day. Yet in each case, no one examined how close the system itself came to a total meltdown. Instead, they took comfort in their models, believing that a process of continuous financial innovation had proved robust against a series of system-shaking shocks. How can these same experts determine a course of action when they do not have

the tools or the skills to understand what caused the whole system, stable for years, to collapse?

Another contributor to the “fog” of crisis prevention and prediction is the general rule that the solutions to one crisis seem always to contain the seeds of the next. Models effective at depicting equilibrium conditions will rarely reveal when seemingly stable systems are about to become unpredictably dynamic. In the initial months after the 2008 financial collapse, for example, a number of U.S. financial system experts proposed segregating the distressed assets (the non-performing loans), moving them off the balance sheets of the banks, and selling them at highly discounted values. If it were only a question of segregating the non-performing from the performing loans, the meltdown could have been reversed. But the proposal, which had seemed to work in East Asia in 1997, was abandoned because it quickly became apparent that the crisis was much larger than just the balance sheets of a few major financial institutions.

## **VI. THE BLAME GAME: CAUSES AND CULPRITS**

In the search for culprits, the most globally cited guilty party is the U.S. financial system itself. From France to China, market liberalism has been attacked as the scourge behind the worldwide system collapse? Yet this same system was the global showcase for capitalism for more than two decades. Many of its primary characteristics, such as the secondary mortgage market, still attract active emulation throughout the world. In economic textbooks, the system is touted as a model of the laws of economics itself. Thus the debates over the future of financial policy—and the apocalyptic claims predicting the

end of U.S. economic supremacy or the death of capitalism—are essentially debates about the future of economics. The battle for interpreting the past will determine how economics is taught and practiced in the future.

A few spectacularly corrupt financial institutions and rapacious individuals also received more than their share of the headlines. The full extent of criminal negligence is just coming to light; nevertheless, the crisis would have occurred with or without the insidious purveyors of Ponzi schemes and sellers of interest-only “liar’s loans.” Disclosing all the malfeasance in the world will not help diagnose the global system’s sudden collapse.

The newly formed Obama administration in 2009 blamed the previous administration. Obama’s Treasury Secretary, Timothy Geithner, blamed the previous Treasury Secretary, Henry Paulson, who in turn blamed the greed of the traders and the deafness of Congress. Other accounts highlight the failure of regulators, the failure of the rating agencies, and the inappropriate remuneration in the financial services sector. Yesterday’s heroes—Alan Greenspan, Robert Rubin, and Larry Summers, once mentioned as the financial dream team of the 1990s—are today’s villains.

Still others search for the one miscalculation that nudged the system to its tipping point. Some critics go back to the repeal in 1999 of Glass-Steagall Act, created after the Great Depression to separate deposit banking from commercial and investment banking. The repeal, they allege, created the mega-banks in the first place, those “too big to fail” behemoths that received hundreds of billions in federal bailout funds. Others point to loosened credit policies after 2001, and still others to the decision to allow large financial institutions to increase their capital/lending ratios in 2004. There are those who point to

the failure to bail out Lehman Brothers in 2008. Joseph Stiglitz proclaimed that a flawed economic philosophy, market liberalism, and deregulation caused the collapse of democratic capitalism, and advocated democratic socialism in its stead (Stiglitz 2009).

The list of potential culprits is as long as there are lists of financial sector experts. In our financial whodunit, we will look at the most frequently cited culprits and causes, from the most mundane—the inflated mortgage market and subprime lending, bank leveraging, the creation of “too big to fail” banks, the conflicts within Freddie and Fannie—to the more exotic offenders, such as skyrocketing executive pay, rating agencies on hire from the firms they rated, risk models too esoteric for even market insiders to grasp, regulators who did not regulate, and the global imbalances perceived by the elite technocrats employed in finance ministries and international financial institutions. All of them became components of instability, but none of them alone explain the origins of the collapse.

### ***A. The Inflated Mortgage Market and Subprime Lending***

The mortgage market, long considered one of the most attractive features of the U.S. financial system, tops almost everyone’s list of culprits. How was it possible that this showcase system, praised and emulated for over twenty years, collapsed virtually overnight?

In short, the mortgage market evolved dramatically during the 1990s until it no longer resembled the system that would-be home owners encountered in the 1980s. Back then, a mortgage applicant was required to pay at least 20 percent to 30 percent of the

price of a home as a down payment, and this only after personal interviews and investigations into employment and credit history. The applicant had to have a particular credit and employment profile, one that excluded certain ethnic groups and professions. Even the lucky few who fell into the right categories had to wait months while their applications were evaluated.

Beginning in the mid-1990s, when loan writers had at their disposal the computational capabilities of supercomputers, a mortgage seeker had only to fill out an application. Formal interviews were eliminated, and individual risks were aggregated into categories according to a borrower's general risk profile. This lowered collateral requirements so that loans of hundreds of thousands of dollars could be obtained with less than 5 percent down. These mortgages could be arranged on the telephone or on the Internet within a matter of days.

This facilitated the creation of secondary markets in which the originating bank pooled and packaged its loans into securities. The streams of payments were divvied up and catalogued according to risk. The riskiest were backed by higher interest rates. The securitized loans were clustered together, repackaged, and resold as a group to investors—and thus, the risk was transferred to the market. This process, called securitization, was consistent with the idea of financial deepening: by creating a larger risk pool, the securitization process made it possible to provide more loans to more people. The existence of this new class of mortgage-backed securities attracted in turn pools of investment capital much larger than what was traditionally available to homeowners. This brought down interest rates offered to individuals and reduced interest rate spreads.

A further deepening of the system occurred when credit default swaps were offered as insurance on the remote probability that the securitized instruments would default.<sup>6</sup> Credit default swaps were, in effect, derivatives created to allow investors to purchase insurance against default by issuers of those mortgage-backed securities. These could be customized according to a client's particular requirements.<sup>7</sup> From the perspective of the late 1980s, the new system looked safe, the capacity of the economy to put people in homes greatly expanded, the financial industry riding on the coattails of the mortgage industry became one of the most profitable in the United States. Investors worldwide wanted access to these securities and to the credit default swaps that insured them.

Politicians of both parties valued particularly the social dimension of these showcase arrangements, which allowed poorer and previously excluded individuals and families to become homeowners and fulfilled an ideological predilection of both the Clinton and Bush administrations to expand homeownership as a means of expanding the appeal of market capitalism. The expansion of homeownership became the centerpiece and most tangible example of the philosophy of democratic capitalism at work.

A more perfect sequence of risk-mitigating devices had never been seen. So what went wrong? For starters, the economy started to slow in 2007 and people who had bought under subprime conditions began having trouble making their mortgage payments. Initially, few observers believed that a collection of bad mortgages could bring the entire financial system to its knees. The problems were mostly in the periphery of the

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<sup>6</sup> Technically, credit default swaps are not insurance. They are not sold exclusively by insurance companies (AIG sold its through a non-insurance subsidiary, purposely to avoid regulation) and are unregulated. Nonetheless, insurance is a good analogy to explain the credit default swap transaction.

<sup>7</sup> One of the problems encountered when these instruments started to malfunction was that they were non-standard; thus, it was impossible to benchmark the probabilities of similar but not identical issues.

system, where, it was reasoned, they would remain. After all how could several hundred billions of dollars in defaults topple a \$5 *trillion* system? Even when the dollar amount of nonperforming mortgages ballooned from about \$200 billion to \$400 billion, between 2006 and 2008, experts had little reason to fear that less than a trillion dollars of losses in the mortgage market could bring a \$200 trillion system to collapse (Puri 2011). Just a few years earlier, the financial services industry had to mark down \$5 trillion worth of technology stocks when a much bigger bubble had burst, but the economy quickly recovered.

Trying to find the origins of the crisis solely in the overheated housing market is problematic. This explanation disregards the hidden impact that the housing market slump was to have on other markets in which mortgage securities and credit default swaps were traded. On its own merits, the housing market bubble was not worrisome enough for analysts to fear the collapse of the whole system. But there are other, independent factors to examine as possible culprits from the list of possible villains.

### ***B. The Leverage Game***

Many people blame the banks for taking the leverage game to new extremes. The banks, they say, tried to leverage securitization in ways that were not originally intended. Securitization itself is not a culprit among the components of instability, but excessive leveraging is.

Securitization is consistent with the democratization of high-yield financial capitalism. It deepened the financial system and dramatically increased home ownership.

The idea behind securitizing mortgages is to transfer credit risk to the financial markets. After the crisis began, it was discovered that many of these securitized assets were actually never transferred. Banks had instead used them as collateral to bolster their own balance sheets in order to make more loans.

Why did the banks violate one of the cardinal benefits of financial innovation and not use securitization to transfer their risk to the credit markets? There is nothing new about the leverage game—banks make money by leveraging their deposits—but a change in the laws during 2004 allowed more money to be leveraged with less skin in the game. Regulatory loopholes permitted the loan originators to “arbitrage the regulations” to inflate their balance sheets, essentially to inflate the value of their assets, and to look more solvent than they actually were.<sup>8</sup> Thus the banks could lend more but put less of their own money on the line.<sup>9</sup>

How did excessive leverage and aggregate risk arise in a sector that is heavily regulated? And why did capital adequacy standards (reserve limits) fail to limit risk? Financial institutions were allowed to reduce the capital they held by moving assets to special investment vehicles they did not own, but to which they extended guarantees. A shadow banking system of hedge funds and bond dealers proliferated to allow banks to unload their riskier products while writing buy-back clauses so that the hedge funds could turn around and leverage the banks’ triple-A ratings.<sup>10</sup> All this activity occurred under the

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<sup>8</sup> Banks were also buying their own securities, as well as their own equities, so it looked as though they were making more money to increase the equity, or share value, of the firm, allowing shareholders to claim higher dividends.

<sup>9</sup> Lehman Bros. wrote mortgages, sold bonds, sold credit default swaps, etc. Countrywide is a similar case. The demand for the mortgage-backed securities was so great that these vendors aggressively marketed the loans and bonds beyond their capacity to operate.

<sup>10</sup> The shadow sector, which constitutes 70 percent of all financial assets, is essential to help rescue the system.

watch of the regulators, leaving behind a trail of massive credit write-offs, regulatory infractions, and poor long-term price performance.

But the capital markets offer many alternatives to banks, we are told, so why should we assume that what happens in one sector of the financial system would be enough to sink the entire system. We must keep searching to find an answer.

### ***C. Large, Complex Financial Institutions***

Another centerpiece of democratic capitalism was the creation of large, complex financial institutions. Post-crisis, the list included nearly insolvent organizations like Bank of America, Citi Group, Chase, and Wells Fargo. The large, complex financial institutions emerged after Congress repealed the Glass-Steagall Act in 1999. Before the repeal, banks that accepted deposits in the United States were barred from investment banking or from underwriting bonds and equities. The commercial side of banking was separated from the investment side of the business to safeguard depositors' nest eggs from high-risk operations.

A massive lobbying campaign by the financial services industry helped end the separation of banking services. The logic was to put deposits to work more efficiently so the public would receive higher returns by gaining access to investment opportunities previously available only to elite investment accounts. Allowing their depositors access to a wider range of investment alternatives would also enable the banks to better manage their own risk. The Securities and Exchange Commission allowed the newly created big banks to increase their debt-to-capital ratio, from 12:1 to 30:0, in April 2004, escalating

the race for high yields. Yields went up and depositors ended up with more money, but much of it in risky assets.

#### ***D. Government-Sponsored Enterprises***

Those icons of democratic capitalism, Freddie Mac and Fannie Mae, these government-sponsored enterprises, are designed as public–private partnerships with a social mission to buy and securitize mortgages.<sup>11</sup> Yet can an institution that enjoys a public mission and implicit government guarantee also have a profit-maximizing strategy? Before his appointment as one of President Obama’s economic advisers, former Treasury Secretary Larry Summers wrote in the *Financial Times* that Freddie and Fannie were riddled with conflicts of interest that gave their CEOs a perverse incentive to gamble. He suggested replacing them with a new system of mortgage finance: either completely privatizing Fannie or making it completely public. As a hybrid, it combines many of the worst qualities of both socialism and capitalism by allowing a private interest to profit from an implicit federal government guarantee.

The flaw in the design concept rests with the fact that the public and private roles of these institutions are in conflict. The government implicitly guarantees private profits but socializes the risks, thus encouraging management to take on too much debt. The shareholders look the other way, assuming the government will bail out them with public money. Yet despite pointing out the flaws of government–private partnerships, the solutions to the financial crisis offer more, not less, of the same practice. Although

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<sup>11</sup> The residential mortgage market is approximately \$10 trillion; 55 percent is securitized. The GSEs manage about \$1.5 trillion and securitized \$3.8 trillion; their leverage ratios are about 25:1

considered to be a proven failure that has cost taxpayers nearly \$150 billion in bailout funds, the share of new mortgages purchased by Freddie and Fannie since the crisis has increased to over 90 percent of all new mortgages.

### *E. Skyrocketing Executive Pay*

Ironically, there is a dangerously undemocratic side to the quest for higher returns on behalf of the investing public. The fund managers became an interest group whose interests diverged sharply from the publics. Yet they acquired the resources and the status to assert that the rise of their industry, and its propagation, were essential to the well-being of the economy. The industry leaders gained the aura of being the economy's alpha males and females. Success in the financial sector gave bond salesmen the wherewithal to become global opinion leaders. James Wolfensohn became president of the World Bank; Michael Milken chaired an annual conference on the global economy attended by Noble Prize winners, and people listened. Senators recalled being awed by the private fortune, said to be over \$700 million, which Treasury Secretary Henry Paulson had acquired as a trader for Goldman Sachs. How could they know better? Perhaps that is why, in the aftermath of the financial collapse, Congress gave Paulson a blank check to manage and distribute the financial recovery funds with little oversight.

Yet post-crisis bonus and incentive schemes in the financial services area are now criticized as recipes for excessive risk taking.<sup>12</sup> And there is considerable discussion of bringing executive compensation into closer alignment with the long-term performance

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<sup>12</sup> There have been calls for locking up bonuses in reserve accounts and permitting clawbacks.

of the products they offer to the public.<sup>13</sup> The problem is that the public, along with the bankers, is lured into the business sector with the highest returns. Bankers are not promoted on how much risk they avoid; their careers depend upon how much money they push out the door or bring in as transaction fees. Within the industry, operators hurt their career prospects if they go on record saying, “I have reservations. I have hesitations. I’m not going to put my client’s money in those assets.” As for the public, it was hard not to develop a taste for higher returns when one’s neighbors were getting 5 percent or 6 percent and installing designer kitchens or buying new cars. But earning higher returns meant putting their investment funds in these innovative, high-risk products.

Critics who had strong reservations about the riskiness of the system found little appetite for their opinions. They were mocked by regulators and politicians who believed that because people were making money, even so much that at times it looked too good to be true, they shouldn’t second-guess the market or intervene. When Brooksley Born of the Commodity Futures Trading Commission wanted to look into the risks of the derivative market, she was told her agency had no authority over derivatives and that her call for action was casting a “shadow of regulatory uncertainty over an otherwise thriving market” . Meanwhile, the amount of private credit (debt) in the market increased about 100 percent between 2001 and 2008, and the government deficit ballooned.

There was another reason for the lax regulations. The regulators were government officials and, by definition, economic nationalists who wanted to keep the profits of industry at home. Financial capitals around the world competed to increase their share in

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<sup>13</sup> Intermediation is efficient when gains created by specialists who augment market liquidity surpass the costs of their activity. Economists generally look the other way when considering the returns earned by financial intermediaries, believing that high returns reflect how efficiently capital is distributed to its most efficient use.

the market, and one way to attract this very lucrative business was to have lower standards than a rival market. Raising standards too high could drive away business. Bankers in Frankfurt did not want to lose business to Dublin; Hong Kong did want to lose to Tokyo; Tokyo did not want to lose to Singapore. National regulators had an incentive to keep standards low because they wanted more business and they were unwilling to strengthen supervisory standards if it meant creating business for somebody else. National regulators have a dual job: they must protect investors, but they must also protect businesses and prevent them from moving overseas to more conducive environments. Considering the mixed objectives that national regulators are held responsible for it is unrealistic to expect an optimal level of global regulation.

#### ***F. The Rating Agencies***

In the early stages of the crisis, experts were sure that conflicts of interest among the rating agencies caused excessively rosy assessments that underestimated the inherent risks of financial innovation. What could have motivated their thinking when they assigned positive ratings to what in hindsight appear to be highly dubious assets? The fact that the rating agencies—Moody’s, Standard & Poor’s, and Fitch—were called National Recognized Statistical Rating Organizations gave the public heightened confidence in the objectivity of their assessments. Their dismal performance is generally attributed to their incentive structures. Rating agencies are paid by the issuers of securities who would bring in more business with positive ratings and turn over more business to the rating agencies. The costs of overly rosy assessments are born by the investors, while the agencies enjoy

First Amendment protection, since their ratings are simply their opinions. However, these privately owned operations play a quasi-public role since their assessments are used by public agencies. Clearly, public policy would benefit by reforming the oligopolistic environment in which the rating agencies operate. But this simple observation overlooks a more subtle problem: the ratings of the collateralized debt obligations failed because the risk management models used by the rating agencies were flawed.

### ***G. The Risk Models***

The financial crisis of 2008 offers little basis for academics to take pride of place over their more practical-minded counterparts or to point fingers at practitioners and accuse them of shortsightedness or narrow self-interest. The conventional risk models used on Wall Street were built on the latest, celebrated economic logic—all based on the well-established efficient market hypothesis, which created an orthodoxy that emanated from halls of academe to the stock trading floors. It idealized a market in which all relevant information is already packed into a price. Yesterday's change will not influence today's movement or tomorrow's price; each change is independent from the last (Mandelbrot 2004).

One such risk model was the Black–Scholes formula for valuing executive stock options. The idea was to use regressions to track past behavior and determine how stocks behave historically. The spreads from a variety of trades are regressed to their historical means; the larger spreads are assumed to decline, the smaller ones to increase. But after profits of \$2.1 billion in a single year and capital subscriptions of \$7 billion, something

unpredictable happened at Long Term Capital Management. The effects of the Russian crisis caused spreads to diverge from their historic averages, leading the hedge fund to the verge of bankruptcy. According to the standard theories, the meltdown that brought down LTCM was a 1-in-5 billion freak accident, an anomaly. But the averages upon which the model was regressed were biased by an insufficiently short time period of ten to fifteen years, when most of the assets being tracked moved in one direction: up. Big price swings, it turned out, were more common than the model presumed.

The properties of a phenomenon in the physical world do not change by measuring it and publicizing the results. But in trading models, the measurement creates real-time feedback by dealers who short and distort, thereby altering the expectations and behaviors of other market participants. The models changed the statistical probabilities in the financial system, as participants responded by placing their bets in gigantic symphony—and moving from safety to crisis. For example, after the publication of the “East Asian Miracle” study by the World Bank in 1993 and the mainstreaming of that phrase by the business media, a glut of investment capital poured into East Asia. But the timing was off and the safe investments had already been placed; when everyone pulled out, the region’s economies collapsed in 1997.

Academic models of risk distribution are available to everyone in the world to use. Turn on your computer, and you would have the same information as someone in New York or London or Tokyo. With a click of the mouse, you can move assets just as fast as anyone else, but when everyone uses the same risk assessments, the money just as quickly moves in the same direction. When everyone puts their bets on the same place, the possibility increases that outliers—the fat tails far from the normal distribution—can

wreak havoc with the system. The misperceptions shared by market participants clustered in certain urban financial centers are amplified.

Risk models work best when they assume that decision makers are independent. When market participants across the globe have the same data on risk and returns, and employ the same optimization models, they end up with largely similar portfolios. Undervalued assets are quickly inflated and cause informational shifts, and these participants rush to the newly designated safe areas, creating new risks that condemn the market to cycles of instability (Persaud 2000). The mix of computers with the human herd instinct produces ever larger bubbles that are now global in scale.

Because the traditional risk models treat the system as though it were closed and as though each outcome is only a matter of adding up the inputs, they fail to anticipate the large impacts of possible small causes—how the internal dynamics of one market can have multiplier effects across the entire system. And once the 2008 crisis began, the capability of these traditional risk models to function collapsed completely. They assumed a distribution of risk that was only realistic during the so-called normal period and could tell us little about the behavior of the risks once they shift in the direction of a crisis.

### ***H. The Regulators***

Why didn't the regulators, who were supposed to protect the public, try to deflate the housing bubble? Why did they not try to stop predatory lending? Many critics allege that the regulators were corrupted into complicity, but there is another perspective from

which to understand their role. The regulators are just like the people who made the investments: enthusiastic, optimistic, forward-looking Americans. Regulators did not protect the public because they were part of it, as blind as everyone else. They believed the same illusions and myths, and when the fundamentals of the game seemed such that only a timid fool would stay away, they behaved like everyone else, acolytes enthusiastically sharing the exuberance and the hubris of the hour. When not conducting their own trades, they cheered for good fortunes of others.

Considerable social and ideological homogeneity made the industry myopic. The trading companies, as well as the regulators, were composed of people of virtually the same backgrounds, who attended the same schools and the same events, read the same columnists, and cited the same books. It became doctrine that market behavior could be synchronized through private incentives in ways that would preserve and constantly “grow” the system. The doctrine was sustained by two decades of almost continuous success at mitigating market fluctuations through innovations that seemed to enhance the resilience of the system. After all, the global system had survived six major threats in the previous decade: the Mexican peso collapse of 1994, the Asian crisis of 1997, the Russian meltdown of 1998, the Brazilian meltdown of 1998–1999, the collapse of Long Term Capital in 1991, and the dotcom crash of 2001. The regulators, like the traders in the trenches, fancied themselves to be battle-hardened members of the financial elite, insiders not by co-option, but because they believed in the same faulty models of risk. They did not imagine that each new mechanism designed to protect the system’s underlying robustness also added to its complexity.

## *I. Perceived Global Imbalances*

U.S. financial authorities have insisted for years that global imbalances—such as a savings glut among America’s principal East Asian trading partners—create market volatility by providing a storehouse of credit and thus inciting risky behavior by borrowers. But blaming the global crisis on the savers has not persuaded central bankers in Asia to change their ways. East Asian central banks started to hold dollar reserves to protect themselves from bank runs like those in 1997, when overseas investors decided to pull out of the region overnight to cover their losses at home. The affected countries, South Korea, Thailand, Indonesia, and Japan, now advance the argument that foreign currency reserves are protection against the fickleness of global capital flows. While U.S. financial officials adhere to the view that the excessive reserves will fuel another credit boom and lead to another cycle of instability, East Asia’s central banks believe they protect themselves by building up currency reserves; and their relative success in weathering the storm of 2008 is likely to persuade their counterparts in other developing countries to do the same thing.<sup>14</sup>

Deeper scrutiny of this hypothesis by Barajas et al. shows that, historically, of 135 credit booms, only 23 of them, or 17 percent, ended in a crisis. Banking crises were frequently preceded by episodes of lending booms (Barajas, Dell’Ariccia, and Levchenko 2007). Of the samples, those booms that inflated asset and real estate prices were most likely to end in crisis.

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<sup>14</sup> Educated opinion has advocated that Asians rebalance their economies through more effective social safety nets to reduce the need for saving; provide support for the small and medium enterprise sector to create new growth centers and encourage deeper and broader capital markets, especially bond markets; and above all to promote domestic consumption. No collective agreement seems likely on any of the above within the region.

So it looks like we have a found a culprit, at least for the inflated housing market. Who allowed those excesses to accumulate? Someone was not minding the store, and that someone was the Federal Reserve. The Federal Reserve was the mastermind behind the lower interest rates that occurred regularly in 2007 and 2008. The Fed's monetary policy was one of the destabilizing forces, a contributor to the overall risk in the system. But do we have our suspect? The jury is clearly not convinced. Most plans for recovery anticipate an even larger role for the Fed to serve as a guarantor of system stability.

## **VII. THE SAFETY AND SOUNDNESS OF THE SYSTEM: DO YOU TRUST THE FED TO MANAGE SYSTEMIC RISK?**

The Federal Reserve is the most likely suspect of having created instability in at least one component of the financial market, but it cannot be labeled the grain of sand that triggered the collapse of the financial system. It was a contributor to systemic risk and uncertainty but not the trigger to the avalanche of the entire system.

The Fed's laissez faire policy and low interest rates produced more mortgages, which were swept up and tiered and resold in successive waves of innovative, high-risk financial instruments that investors, at times the same ones who sold them in the first place, gambled against by purchasing credit derivatives. But as noted, there are a number of other culprits, or components of instability.

The Fed, however, is being heralded again as the most likely source of wisdom to protect the entire system. Apparently alone among federal agencies, it has the capacity and the wherewithal to act as the supercop to protect the financial system from systemic

risk.<sup>15</sup> If not the Fed, then who is better situated to police the entire system,<sup>16</sup> to say that this deal is no good but that deal is okay?

But on what criteria will Fed officials conduct inquiries when there is no consensus among the experts as to what constitutes systemic risk? Why should the Fed be granted overarching authority to regulate something it is incapable of defining? If the judgment of the supercop appears random, traders will innovate less; thus, giving the Fed such a big stick is tantamount to reducing the scope of financial innovation.

Certain critics of the Fed were outspoken long before the financial crisis unfolded. They argued that instead of more control, the Fed should be forced into daylight and its elitist culture ended. William Greider writes in *Secrets of the Temple*, “were they not part of the secretive culture that sanctified the policy of too big to fail?” (Greider 1989) Are they not purveyors to the cozy club of companies that enjoy proximity and privilege? Has there not been a revolving door between the private investment houses and the government agencies that are mandated to regulate them? Clearly the Fed failed to anticipate the systemic effects of two decades of credit expansion, a debt explosion, and inflated valuations.

The Fed has essentially just one tool for dealing with risk: its control and supervision of the money supply. However, system risks are broader than any one segment of the system over which the Fed has jurisdiction. The risk arises from the trading of securities of all kinds across many markets. It arises when the complex web of

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<sup>15</sup> An obvious innovation is for government to collect insurance premiums for the necessary bailout fund.

<sup>16</sup> Senator Charles Grassley, Hearing Before the Committee on Finance: “TARP Oversight: A Six Month Update.” Statement of Ranking Member Charles Grassley. Can the Federal Reserve supervise systemically risky companies without being embroiled in endless lobbying and litigation that compromises its independence? [<http://finance.senate.gov/sitepages/hearing033109.htm> Senator Grassley calls Fed “an appendage of the Treasury.”

intertwining securities causes the system to lock up because market participants cannot surmise the positions or risk exposures of their partners (Gorton 2010). It arises when traders make trades in one segment of the market to cover positions they hold in another.

During the heyday of deregulation, market professionals believed that the threat of counterparty risk would lead to more effective risk management by firms. Before a congressional committee, Alan Greenspan, then Chairman of the Federal Reserve, argued in 1994 and again in 1998 that derivatives did not need to be regulated because the principle of counterparty risk would prompt market participants to regulate each other. After the meltdown the world looks different, and the same market professionals, Greenspan included, have argued that the crisis was a consequence of the actions of individual traders who solved their own problems by creating counterparty risk, which altered the nature of competition for others. Greenspan has since joined the consensus of his colleagues who believe the market is not and never will be a sufficiently adaptive environment to regulate itself. Having conceded in 2008 that “I found a flaw, I don’t know how significant or permanent it is” in 2010 he asserts “I would not have done anything differently” and advocates no changes except for an end to Bush-era tax cuts.<sup>17</sup>

The topic of systemic risk and its elimination raises complex questions that traditional financial economics is not well prepared to answer. Can wholesale financial failure be eliminated? If not, how can we mitigate crisis? Will a bailout sow the seeds of the next crisis? How should it be quantified? Is it even desirable to regulate systemic risk? One trader’s risk may be another trader’s opportunity. Can regulators learn to recognize system risk before the system is in crisis? Can anyone devise purely objective

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<sup>17</sup> <http://www.businessinsider.com/alen-greenspan-interview-2011-1>

criteria for systemic risk, or is this a case of “you’ll know it when you see it”? And if that is true, would the appointment of a supercop, reputed for encouraging over-consumption and over-borrowing, create so much uncertainty that it would deter not only dangerous financial growth but also innovation of the healthy kind? If the decisions of a central supervisor are so difficult to anticipate, would the increased uncertainty deter financial innovation of all types?

Only once we answer such questions will we be possible to obtain a consensus on the appropriate level of regulation. So far there are no feasible alternatives to expanding the Fed’s oversight but there is deep apprehension concerning the Fed’s ability to perform in this new role without surrendering its status as a neutral player.

## **VIII. THE POLICY CONUNDRUM**

Having examined the list of culprits, and dispensing with them one by one, it becomes evident that this is about all we can do—exclude possible grains of sand as causes of the avalanche. The financial system has gained almost impenetrable complexity over the past few decades, and we must study its increasingly turbulent dynamics to know more. Local economies are open systems, subject to system-wide effects. National economies are the components of a much larger system and subject to system-wide effects. Their own internal dynamics can in turn influence the wider system, with repercussions that may rebound upon it. The next generation of regulators must target the system’s most enduring characteristic and conundrum: its proclivity toward periodic, difficult-to-predict avalanches that result from its internal dynamics. Economists,

mathematicians, social scientists, bankers, traders, and politicians do not have the skills or tools to discern or anticipate how these systems fit together and how and why they will fail. We know this much already: that as a complex system, the financial system is sensitive to catastrophic failures from tiny causes (Hubler et al. 2007).<sup>18</sup>

Regulators must learn to ask what characterizes these avalanches. If they cannot discern the actual trigger, they can begin by examining possible causes—the kinds of initial events that might trigger an avalanche, the kinds of linkages and behaviors surrounding an event, potential thresholds that distinguish system meltdowns from non-events (Tornell 2005).<sup>19</sup>

If Tornell is correct, then it is crucial to re-examine the basis both for confidence in a financial system and the soundness of its financial institutions. Market risk is nested in political and social risk, while a nation's ability to exit a financial crisis is fundamentally a question of trust—of consent and credibility within the polity. It is the confidence in the underlying solidity of social institutions and the legitimacy of political institutions that constitutes the financial system's underlying strength and the absence of such trust that causes polities that suffer deep social divides to have underdeveloped financial systems. Institutions that manage risk well, that can convert household risk into

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<sup>18</sup> Also see other works by A. Hubler et al. (Hubler et al. 2007; Foster, Hubler, and Dahmen 2007)

<sup>19</sup> Aarón Tornell reports that countries that embrace innovation grow fastest but are also more likely to experience a financial crisis.<sup>19</sup> In crisis after crisis, the countries with open financial markets took the hardest hits. South Korea, for example, opened its stock markets to foreign hedge funds that eventually acquired half of the country's market capitalization. When the funds pulled out, values crashed. The countries that grow the fastest are the countries in which boom and bust cycles, and prosperity and crisis are pairs, just like capitalism and collusion. Just as no one has found a way to deter short-term investment if he wants to receive long-term flows, to fully eliminate the risk of high growth and financial fragility, we would have to close the financial markets. A high-growth economy without financial risks has yet to be discovered. Instead of trying to take the risk out of finance market economies, we need policies that anticipate the avalanches of financial market change. Gigantic perturbations may be a universal feature of system changes from which an increasingly optimized set of economic institutions is derived.

social risk rather than vice versa, become an essential defense against crisis contagion. Likewise, a government whose commitments to reform and payment of the national debt are credible exhibits firm social foundations. Significant amounts of debt can be sustained when financial policy has institutionalized public support behind it.

To return to the analogy of the grain of sand in the sand pile, we know that a grain of sand can affect the pile's internal dynamics. But we do not yet know if a particular grain of sand was consequential in its own right or because the pile was already in a state of criticality, at the edge of collapse, due to other, unobservable internal dynamics. Just as we do not therefore know which grain of sand may cause the avalanche, we do not yet know which sand pile in a larger system is on the edge of a meltdown. We may in fact never be able to access this information. Thus, the best defense will be financial systems designed with multiple fail-safe faculties operating at different scales.

Although it is critical to keep the micro-from macro-evolutionary effects distinct for analytical purposes, because financial systems are open systems what happens at one level will have impacts on the wider global system and what happens at the macro level will effect the micro level. Financial economics is now challenged to develop an approach to distinguish these two classes of phenomena while using the same body of theory to address each.

Bak, Per. 1999. *How Nature Works: The Science of Self-Organized Criticality*. 1st ed.

Springer.

Barajas, Adolfo, Giovanni Dell'Ariccia, and Andrei Levchenko. 2007. *The Good, the Bad, and the Ugly*. Washington, DC: International Monetary Fund.

Foster, G., A. Hubler, and K. Dahmen. 2007. "Resonant Forcing of Multidimensional Chaotic Map Dynamics." *Physics Review* 75.

Gorton, Gary B. 2010. *Slapped by the Invisible Hand: The Panic of 2007*. Oxford University Press.

Greider, William. 1989. *Secrets of the Temple: How the Federal Reserve Runs the Country*. 1st ed. New York: Simon & Schuster.

Hubler, A., G. Foster, and K. Phelps. 2007. "Managing Chaos: Thinking Out of the Box." *Complexity* 12:10-13.

Joseph E. Stiglitz. 2009. "Capitalist Fools." *Vanity Fair* 51:48.

Kauffman, Stuart A. 1993. *The Origins of Order: Self-Organization and Selection in Evolution*. 1st ed. Oxford University Press, USA.

Levin, Simon. 2009. *The Princeton Guide to Ecology*. Princeton University Press.

Levin, Simon. 1992. "The Problem of Pattern and Scale." *Ecology* Vol 73:1943-1967.

Lohr, Steve. 2008. "In Modeling Risk, the Human Factor Was Left Out." November 4.

Mandelbrot, Benoit B. 2004. *The (mis)behavior of Markets: A Fractal View of Risk, Ruin, and Reward*. New York: Basic Books.

Persaud, Avinash. 2000. *Sending the Herd off the Cliff Edge: The Disturbing Interaction between Herding and Market-Sensitive Risk Management Systems*. Washington, DC: Institute of International Finance.

Puri, Shilpa. 2011. "Distribution of Global Financial Assets.".

Shermer, Michael. 2007. *The Mind of The Market: Compassionate Apes, Competitive Humans, and Other Tales from Evolutionary Economics*. 1st: Times Books.

Thaler, Richard H., and Cass R. Sunstein. 2008. *Nudge: Improving Decisions About Health, Wealth, and Happiness*. The Penguin Group.

Tornell, Aarón. 2005. *Boom-Bust Cycles and Financial Liberalization*. Cambridge, Mass: MIT.