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REGULATING COMPLEXITY IN FINANCIAL MARKETS*

STEVEN L. SCHWARCZ**

ABSTRACT

As the financial crisis has tragically illustrated, the complexities of modern financial markets and investment securities can trigger systemic market failures. Addressing these complexities, this Article maintains, is perhaps the greatest financial-market challenge of the future. The Article first examines and explains the nature of these complexities. It then analyzes the regulatory and other steps that should be considered to reduce the potential for failure. Because complex financial markets resemble complex engineering systems, and failures in those markets have characteristics of failures in those systems, the Article's analysis draws on chaos theory and other approaches used to analyze complex engineering systems.

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** Stanley A. Star Professor of Law & Business, Duke University School of Law; Founding/Co-Academic Director, Duke Global Capital Markets Center. E-mail: schwarcz@law.duke.edu. The author testified before the U.S. House of Representatives Committee on Financial Services, and also was an Academic Advisor to the U.S. Federal Reserve Bank of Cleveland, on the subprime mortgage crisis. He thanks Lawrence Baxter, Richard Bookstaber, Robert Cochran, Edward Kane, Jonathan Lipson, Allan H. Meltzer, Saule T. Omarova, Daniel Schwarcz, Joseph Sommer, Lodewijk Van Setten, Charles Whitehead, and participants in faculty workshops at Duke University, Emory Law School, Georgia State University School of Law, Notre Dame Law School, and Western Ontario University Faculty of Law for superb comments on this Article and Justin Jesse, Emily Johnson, Nikhil S. Palekar, Arman Tasheneff, and Benjamin Wilson for excellent research assistance. This research was supported in part by The Eugene T. Bost, Jr. Research Professorship of the Charles A. Cannon Charitable Trust No. 3.

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I. INTRODUCTION

In a recent article, I examined financial-market anomalies and obvious market and regulatory protections that failed, seeking insight into the subprime financial crisis and its subsequent devolution into a larger global financial crisis.[1] The crisis, I argued, can be attributed in large part to three causes[2]: conflicts, complacency, and complexity.[3] This Article focuses on

1. Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, 93 MINN. L. REV. 373 (2008) [hereinafter Schwarcz, *Protecting Financial Markets*]. This Article refers to these crises collectively as the "subprime crisis." *Id.*

2. Running throughout these causes is a fourth cause, cupidity; but because greed is so ingrained in human nature and so intertwined with the other causes, it adds little insight to view it separately.

3. *Id.* at 376. These causes do not fully capture the problem of systemic risk, which can arise from a type of tragedy of the commons; because the benefits of exploiting finite capital resources accrue to individual market participants, whereas the costs of exploitation, which affect the real economy, are distributed among an even wider class of persons, market participants have insufficient incentive to internalize their externalities. Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 206 (2008). *Cf.* Martin Hellwig, *Systemic Risk in the Financial Sector: An Analysis of the Subprime-Mortgage Financial Crisis* 52 (Preprint of the Max Planck Institute for Research on Collective Goods, Nov. 2008), *available at* www.ssrn.com/abstract=1309442 (observing that "given the complexity and the fluidity of the network of interbank relations, there is no way in which the quantitative risk model of an individual bank could satisfactorily take account of the institution's exposure to systemic risk"); Henry T.C. Hu, *Misunderstood Derivatives: The Causes of Informational Failure and the Promise of Regulatory Incrementalism*, 102 YALE L.J. 1457, 1502 (1993) (observing that "[g]overnment, rather than the private sector, has the incentive . . . to become informed about systemic risks"). Therefore, even in a simple financial system with no conflicts, no complacency, and no greed, systemic risk is theoretically possible absent regulation to address this collective-action problem. Steven L. Schwarcz,

the third cause, complexity, which I regard as the greatest financial-market challenge of the future.[4]

Complexity in financial markets does not necessarily "arise for complexity's sake, nor from a desire to obfuscate."[5] Rather, it arises in response to "demand by investors for securities that meet their investment criteria and their appetite for ever higher yields"[6] and in order to facilitate the transfer and trading of risk to those who prefer to hold it, promoting efficiency.[7] For example, more complex securities can offer investors the opportunity to gain exposure to new asset types and markets—such as foreign currency, commodities, or residential mortgages—in turn enabling them to earn higher returns and more precisely hedge risk.[8] Complex securities issued by special-purpose vehicles and backed by pools of financial assets[9] also enable firms to raise low-cost financing by accessing

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Keynote Address: Understanding the Subprime Financial Crisis, 60 S.C. L. REV. 549, 562 (2009) [hereinafter Schwarcz, *Keynote Address*], *available at* http://ssrn/abstract_id=1288687.

4. *Cf.* Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 405 (concluding that "[s]olving problems of financial complexity may well be the ultimate twenty-first century market goal"). Although this Article focuses on financial-market complexity, a related challenge is whether the increasing size and complexity of financial institutions causes corporate-governance failures. My Duke Law School colleague, Lawrence Baxter, has separately been examining that challenge.

5. Peter Green & Jeremy Jennings-Mares, Letter to the Editor, FIN. TIMES, July 4, 2008, at 14. At the margins, however, complexity may well arise for complexity's sake or to obfuscate. *Cf.* Bruce I. Carlin, *Strategic Price Complexity in Retail Financial Markets*, 91 J. FIN. ECON. 278 (2009) (finding that firms sometimes make the pricing of *retail* financial products—such as mortgage loans, credit cards, and mutual funds—overly complex in order to mislead consumers into purchasing the products notwithstanding their higher price); Bruce Ian Carlin & Gustavo Manso, Obfuscation, Learning, and the Evolution of Investor Sophistication (Apr. 29, 2009) (unpublished draft, on file with author) (examining the relationship between obfuscation and investor sophistication); Jonathan C. Lipson, Failure's Futures: Controlling the Market for Information in Corporate Reorganization 67 (Aug. 9, 2008) (unpublished manuscript, on file with author) (arguing that complexity may "breed[] opacity" that allows people to "gain at the expense of [others]" rather than merely making markets efficient, and characterizing the trend towards inefficient complexity as the problem of "transactional entropy"). Unlike Professor Carlin's research, my Article addresses complexity in the context of sophisticated market players. In that context, even Professor Carlin would agree that the intentional obfuscation he discusses would be inapplicable. *See* Carlin & Manso, *supra*, at 2 (distinguishing "experts" from "non-expert" consumers, and focusing only on the latter category as problematic).

6. Green & Jennings-Mares, *supra* note 5. The supply-side of this investor demand is that financial innovators likewise see customized financial products as a means of staying competitive, by "constantly introduc[ing] new financial products because [profit] margins on products decline quickly." Hu, *supra* note 3, at 1479 (citations omitted).

7. Jennifer Bethel & Allan Ferrel, *Policy Issues Raised by Structured Products*, *in* NEW FINANCIAL INSTRUMENTS AND INSTITUTIONS: OPPORTUNITIES AND POLICY CHALLENGES 167, 171 (Yasuyuki Fuchita & Robert E. Litan eds., 2007) (explaining that structured products can promote efficiency in this way); *see also* Steven L. Schwarcz, *The Alchemy of Asset Securitization*, 1 STAN. J.L. BUS. & FIN. 133, 134 (1994) (explaining that by separating a corporation's liquid assets from its risks, it may obtain lower cost financing than if it were to directly issue debt or equity).

8. Bethel & Ferrel, *supra* note 7, at 173.

9. The term "financial assets" includes any type of asset, such as accounts receivable, rental payments, franchise payments, loans, or other rights to payment, that over a finite period of time

the ultimate source of funds, the capital markets, without going through banks or other financial intermediaries.[10] Complexity thus can add efficiency and depth to financial markets and investments.

Nonetheless, complexity can also impair markets and investments in several interrelated ways. Part II.A of this Article examines how complexities of the assets underlying modern investment securities and the means of originating those assets can lead to a failure of lending standards and unanticipated defaults. Complexity in this sense derives from the intricate combining of parts, creating complications that increase the likelihood that failures will occur and diminish the ability of investors and other market participants to anticipate and avoid these failures.[11]

Part II.B of the Article examines how complexities of the investment securities themselves can lead to a failure of investing standards and financial-market practices. Complexity in this sense derives not only from complication, but also from the difficulty of valuation. Senior securities, for instance, can carry higher credit ratings than, and can be valued above, the ratings and value of their underlying assets.[12] Complexity deriving from complication and valuation difficulty can be thought of as cognizant complexity; things are just too complex to understand.[13]

Part II.C of the Article examines how complexities of modern financial markets can exacerbate these failures. For example, markets consisting of securities that pool together multiple classes of assets can create a "complex system" in which price volatility and liquidity are nonlinear functions of patterns arising from the interactive behavior of many

converts into cash. *See* Edward M. Iacobucci & Ralph A. Winter, *Asset Securitization and Asymmetric Information*, 34 J. LEGAL STUD. 161, 162 (2005). *Cf.* 17 C.F.R. § 270.3a-7 (2009) (related definition of "Eligible Asset" under S.E.C. Rule 3a-7).

10. Steven L. Schwarcz, *Enron and the Use and Abuse of Special Purpose Entities in Corporate Structures*, 70 U. CIN. L. REV. 1309, 1315 (2002) [hereinafter Schwarcz, *Enron*]. Capital markets are now the nation's and the world's most important sources of investment financing. *See, e.g.*, MCKINSEY GLOBAL INSTITUTE, MAPPING THE GLOBAL CAPITAL MARKETS THIRD ANNUAL REPORT (2007), http://www.mckinsey.com/mgi/publications/third_annual_report/index.asp (reporting that as of the end of 2005, the value of total global financial assets, including equities, government and corporate debt securities, and bank deposits, was $140 trillion).

11. *Cf.* Merriam-Webster Online, Complex, http://www.merriam-webster.com/dictionary/complex (last visited June 5, 2008); Merriam-Webster Online, Complicated, http://www.merriam-webster.com/dictionary/complicated (last visited June 5, 2008) (defining "complicated" as "consisting of parts intricately combined" or "difficult to analyze, understand, or explain").

12. *See infra* note 46.

13. *See* Schwarcz, *Keynote Address*, *supra* note 3, at 563. Social psychology uses a related term, "cognitive complexity," to refer to different people perceiving the same phenomena on different levels of complexity. Some people tend to notice more and, thus, have a more nuanced view of a given phenomena, others notice less and, therefore, have a simplified view. *See, e.g.*, JON E. ROECKELEIN, DICTIONARY OF THEORIES, LAWS, AND CONCEPTS IN PSYCHOLOGY 98–99 (1998).

independent and constantly adapting market participants.[14] This not only can produce cognizant complexity[15] but also a "tight coupling" within credit markets in which events tend to move rapidly into a crisis mode with little time or opportunity to intervene.[16] This additional nature of complexity is temporal;[17] in a complex system, signals are sometimes inadvertently transmitted too quickly to control.[18]

Finally, Part III of the Article analyzes possible solutions to these market failures. The failures have characteristics similar to those that engineers have long faced when working with complex systems that have nonlinear feedback effects, and indeed many characteristics of complex engineering systems are similar to those of financial markets.[19] This Part, therefore, examines solutions inspired by chaos theory, which helps to inform engineers about complex systems with nonlinear feedback effects.

Prescriptive regulation can begin to address existing market failures, but financial markets evolve so rapidly and often in such unexpected ways that prescriptive regulation can never address all potential failures. Prescriptive regulation also can sometimes create unintended, adverse consequences. Chaos theory addresses these dilemmas. Because failures are almost inevitable in complex systems, successful systems are those in which the consequences of a failure are limited. This can be done by decoupling systems through modularity, helping to reduce the chance that a failure in one part of a complex system will systemically trigger a failure in another part.

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14. *Cf.* P.G. DRAZIN, NONLINEAR SYSTEMS 1 (1992) (observing that nonlinear systems represent "a feedback loop in which the output of an element is not proportional to its input").

15. *Cf.* Jason Kravitt, *Foreword: Some Thoughts on What Has Happened to the Capital Markets and Securitization and Where Securitization is Going* 9 (Aug. 7, 2008), http://www.pli.edu/public/17984/foreword.pdf ("[T]he more complicated a system becomes, and the more interconnected, . . . the odds of a breakdown in a portion of the system increases (because of complexity) . . . .").

16. I thank Rick Bookstaber for introducing the term "tight coupling," originally borrowed from engineering nomenclature, to financial markets. *See* BOOKSTABER, *infra* note 68, at 144. Tight coupling is most pronounced when markets are illiquid and market participants are highly leveraged.

17. The effects of these types of complexity (i.e., cognizant and temporal) can combine, however, such as the cognizant complexity caused by the unexpected consequences of marking-to-market, which (like a complex engineering system subject to nonlinear feedback effects) resulted in a downward spiral of prices when marking-to-market occurred in unstable markets. *See infra* notes 119–22 and accompanying text.

18. Schwarcz, *Keynote Address*, *supra* note 3. *Cf.* W. Brian Arthur, *Complexity and the Economy*, 284 SCIENCE 107 (1999) (defining economic complexity as the tendency for patterns to emerge from systems, organizations, or products with many interdependent parts or actors that would not be predicted from classical linear economic models).

19. This Article is not the first to draw an analogy between financial markets and nonlinear engineering systems. *Cf.* BOOKSTABER, *infra* note 68 (drawing similar analogies); David A. Hsieh, *Chaos and Nonlinear Dynamics: Application to Financial Markets*, 46 J. FIN. 1839 (1991).

To this end, Part III examines possible solutions, including creation of a market liquidity provider of last resort to provide functional modularity by limiting the consequences of financial-market failure. The costs of such a market liquidity provider (which could be largely privately funded) should be relatively minimal, especially compared with the costs of a lender of last resort to financial institutions—the role played by the U.S. Federal Reserve and foreign central banks. Had a market liquidity provider of last resort been in existence when the subprime crisis started, the resulting collapse of the credit markets may well have been restricted in scope and lessened in impact. Furthermore, by stabilizing financial markets, a market liquidity provider of last resort could minimize the quandary, increasingly faced during the subprime crisis, of a lender of last resort being forced to lend to financial institutions deemed "too big to fail."

II. COMPLEXITY CAN CAUSE MARKET FAILURES

This Part examines various ways in which complexity can cause market failures.

A. Complexities of the Assets Underlying Investment Securities and of the Means of Originating Those Assets

The complexities of the assets underlying investment securities, and of the means of originating those assets, can lead to a failure of lending standards and unanticipated defaults. Consider first the complexities of the underlying assets, which can include mortgage loans and a wide range of other financial assets.[20] Each type of underlying asset requires a separate approach to modeling, including estimation of default risk, interest-rate risk, and prepayment risk (the risk that the borrower might prepay the loan balance at any time, thereby jeopardizing the asset's anticipated return on investment).[21] To further complicate matters, prepayment risk is correlated

20. Iacobucci & Winter, *supra* note 9, at 162.

21. THOMAS S. Y. HO & SANG BIN LEE, THE OXFORD GUIDE TO FINANCIAL MODELING: APPLICATIONS FOR CAPITAL MARKETS, CORPORATE FINANCE, RISK MANAGEMENT, AND FINANCIAL INSTITUTIONS 348 (2004). Some assets, such as credit-card loans, are further complicated because, unlike mortgage loans, they have no fixed payment amount or amortization schedule. Borrowers may pay in full, pay a minimum payment (usually 2% of the outstanding balance), or even increase their balance up to a specified credit limit. Mark Furletti, An Overview of Credit Card Asset-Backed Securities 2 (Dec. 2002) (unpublished manuscript, on file with author); Suleman Baig, *CDO of ABS: A Primer on Performance Metrics and Test Measures* 4, http://www.yieldcurve.com/mk+research/files/suleman_CDOABSDec03.pdf (last visited June 12, 2008). To address these challenges, credit-card

with interest-rate risk: when rates fall, borrowers are more likely to prepay; whereas when rates rise, borrowers are more likely to default.[22] These risks are also dynamic in that they fluctuate over time, and mathematical models that attempt to estimate the dynamic correlation are, at best, approximations.[23] Furthermore, as models become more sophisticated to take into account interest rate movements, they rely on an increasing number of assumptions and historical data which, if incorrect, will generate incorrect data.[24] When multiple asset classes underlie a given class of securities, modeling can become exponentially complicated.

In addition to complex modeling, the terms and conditions of financial assets can also be complex. In the subprime crisis, for example, loan originators made mortgage-loan products more varied and sophisticated, and offered these products to a wider range of borrowers, purportedly in order to meet market demand.[25] These products included terms such as adjustable rates, low-to-zero down payment requirements, interest-only payment options, and negative amortization.[26] Because of this complexity, some borrowers did not fully understand the risks they were incurring[27] and, as a result, defaulted at a much higher rate than would be predicted by the historical mortgage-loan default rates relied on by loan originators in extending credit.[28]

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securities are typically issued separately through a revolving master trust, within which several credit accounts are pooled together to allow for multiple bond issues as well as a revolving flow of receivables. Baig, *supra*, at 4.

22. MARK ADELSON, MBS BASICS 7 (2006) (describing the property of negative convexity in mortgage-backed securities).

23. HO & LEE, *supra* note 21, at 348–49 (discussing Monte Carlo simulations, which condition prepayment risk upon hypothetical interest rate fluctuations); *see also* Advanced Analytics, Inc. v. Citigroup Global Mkts., Inc., No. 04 Civ. 3531 (LTS) (HBP), 2008 WL 2557421, at *1 (describing as "complex" the computerized process used to estimate prepayment risk).

24. ADELSON, *supra* note 22, at 9.

25. EDWARD VINCENT MURPHY, ALTERNATIVE MORTGAGES: RISKS TO CONSUMERS AND LENDERS IN THE CURRENT HOUSING CYCLE, CRS REPORT 5–6 (2006), http://assets.opencrs.com/rpts/RL33775_20061227.pdf.

26. *Id.* at 2–3.

27. Patricia A. McCoy & Elizabeth Renuart, *The Legal Infrastructure of Subprime and Nontraditional Home Mortgages* 19 (2008), http://www.jchs.harvard.edu/publications/finance/understanding_consumer_credit/papers/ucc08-5_mccoy_renuart.pdf.

28. Edward Golding, Richard K. Green & Douglas A. McManus, *Imperfect Information and the Housing Finance Crisis* 16 (2008), http://www.jchs.harvard.edu/publications/finance/understanding_consumer_credit/papers/ucc08-6_golding_green_mcmanus.pdf (last visited July 21, 2008); *see also Subprime Mortgage Market Turmoil: Examining the Role of Securitization: Hearing Before the S. Banking, Hous., and Urban Subcomm. on Sec., Ins., and Invs.*, 110th Cong. 4 (2007) (statement of Kurt Eggert, Professor of Law, Chapman University School of Law), *available at* http://banking.senate.gov/public/_files/eggert.pdf.

The complexities of the means of originating these assets also can lead to a failure of lending standards. For example, the originate-to-distribute model of mortgage lending,[29] under which mortgage lenders would sell off loans as they were made,[30] is believed to have contributed to the subprime crisis.[31] Third parties—including government-sponsored enterprises such as Federal National Mortgage Association (Fannie Mae) and Federal Home Loan Mortgage Corporation (Freddie Mac), direct government entities such as the Government National Mortgage Association (Ginnie Mae), and private investment banks—would purchase the loans and package them into mortgage-backed securities, or "MBS."[32] This "securitization" process increased the accessibility and affordability of mortgage lending by indirectly funding such lending through the capital markets.[33] Nonetheless, because the interests of the lenders were no longer aligned with the interests of the owners of the loans (the investors in the MBS effectively becoming owners of the loans), there is concern that the originate-to-distribute model fostered moral hazard on the part of the lenders,[34] resulting in lax lending standards.[35]

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29. This model is also referred to as "originate-and-distribute."

30. Unlike lending practices common several decades ago, today mortgages are most often sold to third parties shortly after being written: thus, originated and then distributed. Richard J. Rosen, *The Role of Securitization in Mortgage Lending*, CHI. FED. LETTER (Fed. Reserve Bank of Chicago, Chicago, Ill., Nov. 2007).

31. *See, e.g.*, Gary B. Gorton, *The Panic of 2007* 68 (Nat'l Bureau of Econ. Research, Working Paper No. 14358, 2008) (stating that the originate-to-distribute model is the "dominant explanation" for the financial panic). *But cf.* Efraim Benmelech, Jennifer Dlugosz & Victoria Ivashina, *What Lies Beneath: Is There Adverse Selection in CLO Collateral*?, http://ssrn.com/abstract_id=1344068 (finding, empirically, that bank loans that are securitized perform no worse than bank loans that are held).

32. *See* Gorton, *supra* note 31, at 68.

33. *Id.* The capital markets are "markets where capital funds—debt and equity—are traded. Included are private placement sources of debt and equity as well as organized markets and exchanges." JOHN DOWNES & JORDAN ELLIOT GOODMAN, DICTIONARY OF FINANCE AND INVESTMENT TERMS 59 (3d ed. 1991).

34. "Moral hazard" means, in this context, the greater tendency of people who are protected from the consequences of risky behavior to engage in such behavior. *See, e.g.*, Charles G. Hallinan, *The "Fresh Start" Policy in Consumer Bankruptcy: A Historical Inventory and an Interpretive Theory*, 21 U. RICH. L. REV. 49, 84 (1986).

35. Martin Feldstein, Op-Ed., *How to Stop the Mortgage Crisis*, WALL ST. J., Mar. 7, 2008, at A15 (describing lax lending standards that gave rise to mortgages with loan-to-value ratios of nearly 100%, and citing the 1.8 million mortgages then in default); David Henry & Matthew Goldstein, *The Bear Flu: How it Spread*, BUS. WK., Dec. 31, 2007, at 30 (arguing that the distance between mortgage-loan originators and the ultimate holders of the loans encouraged lax lending). *Cf.* John C. Dugan, Comptroller of Currency, Speech Given at the Annual Convention of The American Bankers Association 5 (Oct. 8, 2007) (transcript available at http://www.occ.treas.gov/ftp/release/2007-109a.pdf) (observing that with the increasing use of the originate-to-distribute model of lending, lending standards shifted from evaluating the likelihood of repayment to evaluating the likelihood that the loan could be sold); The Big Picture, http://bigpicture.typepad.com/comments/2008/10/why-

An important question here is why the ultimate owners of the loans—the distributees, which in the subprime crisis were the parties buying the mortgage-backed securities[36]—did not impose on the originator the same strict lending standards that they would otherwise observe but for the separation of origination and ownership.[37] There appear to be several answers, with ramifications beyond the subprime crisis. First, by separating the ultimate owners of the mortgage loans from the actual lenders, an originate-to-distribute model makes it difficult for those owners to always see the big picture.[38] Like the fable of a blind person describing an elephant by touching only a part,[39] owners often focused on isolated aspects of the market. Separating the ultimate owners also can create a collective-action problem when those owners are widely dispersed.[40] This occurred in the subprime crisis through the securitization of subprime mortgage loans, making it difficult for owners to agree on underlying lending standards as well as making it difficult to agree on loan monitoring, or "servicing," standards.[41] Furthermore, to the extent an originate-to-distribute model reduces the size of any given owner's investment below an amount sufficient to motivate the owner to engage in due diligence and monitoring, it could induce undue reliance on rating-agency ratings.[42]

The foregoing discussion focused on complexities of the assets underlying modern securities and the means of originating those assets.

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lending-sta.html (Oct. 21, 2008, 07:21 EST) (arguing that originators tried to find borrowers who could afford the low "teaser" rates for a few months, which led to the implosion of 293 mortgage lenders).

36. *See, e.g.*, Rosen, *supra* note 30 (describing the process of mortgage securitization as the sale of loans to an investor who might hold them or repackage loans into securities—which may in turn be sold or again repackaged—such that the ultimate mortgage owner is several steps removed from the borrower).

37. Most investors in securities are sophisticated institutions. SEC. AND EXCH. COMM'N, STAFF REPORT: ENHANCING DISCLOSURE IN THE MORTGAGE BACKED SECURITIES MARKETS (2003), *available at* http://www.sec.gov/news/studies/mortgagebacked.htm (reporting that investors in mortgage-backed securities are "overwhelmingly institutional").

38. *See, e.g.*, Dugan, *supra* note 35, at 6 (arguing that investors were unable to fully understand the complicated securities they bought); Telephone Interview with Alan Hirsch, Director, N.C. Policy Office (Feb. 20, 2008) [hereinafter Hirsch] (observing that the originate-to-distribute model made the structure "so complex that no one followed the trail").

39. *See* JOHN GODFREY SAXE, THE POETICAL WORKS OF JOHN GODFREY SAXE 111–12 (Boston, Houghton, Mifflin, & Co. 1882) (the poem, "The Blindmen and the Elephant," based on a South Asian parable).

40. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 390–91.

41. *Id.*; *see also* Feldstein, *supra* note 35, at A15 (explaining that the separation of borrowers from the ultimate owners of mortgages frustrated the ability to effectively service or renegotiate troubled loans).

42. *See infra* note 187 and accompanying text.

The next discussion focuses on complexities of the securities backed by these assets.

B. Complexities of Modern Investment Securities

The complexities of modern investment securities can lead to a failure of investing standards and financial-market practices for several reasons: these complexities impair disclosure; they obscure the ability of market participants to see and judge consequences; and they make financial markets more susceptible to financial contagion and also more susceptible to fraud.

To provide perspective, the subprime crisis involved complex forms of mortgage-backed securities. In their simplest form, these securities are typically issued through special-purpose vehicles (SPVs, sometimes called special-purpose entities, or SPEs), and payment on such securities derive principally or entirely from the mortgage loans owned by the SPVs. More complex forms of MBS include CDO, or "collateralized debt obligation,"[43] securities backed by—and, thus, whose payment derives principally or entirely from—a mixed pool of mortgage loans and other financial assets owned by SPVs;[44] and ABS CDO securities backed by a mixed pool of mortgage- and other asset-backed securities. The classes, or "tranches," of these securities are typically ranked by seniority of payment priority, with the highest priority classes being called "senior securities," lower priority classes usually being called "mezzanine securities," and the lowest priority class, which has a residual claim against the SPV, being called the "equity."[45] The senior and many of the subordinated classes of these securities are more highly rated than the quality of the underlying mortgage loans.[46]

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43. There are even more arcane variations, such as CDOs "squared" or "cubed," but they go beyond this Article's analysis.

44. Securities backed by assets *other than mortgage loans* are sometimes referred to in the securitization industry as "asset-backed securities" or "ABS." This Article will use the term asset-backed securities to generically mean securities backed by any types of assets, including mortgage loans.

45. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 376–78.

46. For example, senior securities issued in a CDO transaction are usually rated AAA even if the underlying income-generating assets consist of subprime mortgages, and senior securities issued in an ABS CDO transaction are usually rated AAA even if none of the underlying securities supporting the transaction are rated that high. This is accomplished by allocating cash collections first to pay the senior classes and thereafter to pay more junior classes. In this way, the senior classes are highly overcollateralized to take into account the possibility, indeed likelihood, of delays and losses on collection. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 378.

Huge segments of modern finance in the United States and abroad continue to operate in similar ways, involving the complex issuance by SPVs of securities backed by a wide range of financial assets (such securities generally known as "asset-backed securities," and the process of creating and issuing asset-backed securities generally known as "securitization"[47]). The potential of these complexities to impair disclosure, to obscure the ability of market participants to see and judge consequences, and to make financial markets more susceptible to financial contagion and fraud therefore goes beyond mortgage-backed securities and the subprime crisis.

Complexities of Securities Can Impair Disclosure. Complexity can deprive investors and other market participants of the understanding needed for markets to operate effectively.[48] Even if all information about a complex structure is disclosed,[49] complexity increases the amount of information that must be analyzed in order to value the investment with a degree of certainty. This additional analysis entails higher cost.[50] According to rational ignorance theory, there is a point at which the benefit obtained from additional analysis can be outweighed, or at least appear to be outweighed, by the costs of performing that analysis.[51] In the context of securities markets, this means that firms deciding whether to allocate more analyst time or hire additional experts to analyze possible

47. Securitization generally means the process of turning financial assets into securities issued by an SPV. Schwarcz, *The Alchemy of Asset Securitization*, *supra* note 7, at 135; *see also* STEVEN L. SCHWARCZ, STRUCTURED FINANCE, A GUIDE TO THE PRINCIPLES OF ASSET SECURITIZATION § 1:1, at 1–2 (3d ed. 2002 & Supp. 2006) [hereinafter SCHWARCZ, STRUCTURED FINANCE] (discussing securitization as a dominant means of financing in the United States and abroad).

48. *See generally* Steven L. Schwarcz, *Rethinking the Disclosure Paradigm in a World of Complexity*, 2004 U. ILL. L. REV. 1 [hereinafter Schwarcz, *Rethinking the Disclosure Paradigm*].

49. *Cf.* Malcolm Gladwell, *Open Secrets: Enron, Intelligence, and the Perils of Too Much Information*, NEW YORKER, Jan. 8, 2007, at 44 (distinguishing between transactions that are merely "puzzles" and those that are truly "mysteries"). To the extent complexity is merely a puzzle, investment bankers theoretically could understand it. In practice, though, "[m]any investors do not possess the resources to fully analyze complicated structured products." Kravitt, *supra* note 15, at 18.

50. *See* Anuj K. Shah & Daniel M. Oppenheimer, *Heuristics Made Easy: An Effort-Reduction Framework*, 134 PSYCHOL. BULL. 207, 207 (2008) (describing costs of information analysis as identification of relevant data, storing of that data, assessing the weight of each piece of data, integrating alternative sources of data, and parsing or analyzing the data to produce actionable information).

51. Community Leader's Letter, Econ. Brief No. 29, The Theory of Rational Ignorance, http://www.strom.clemson.edu/teams/ced/econ/8-3No29.pdf; *see also* Schwarcz, *Rethinking the Disclosure Paradigm*, *supra* note 48, at 13–15 (explaining why institutional investors face declining incentives to hire experts to parse information relating to structured products as those products increase in complexity).

investments might view the added tangible costs as outweighing the uncertain gain.[52]

Prior to the subprime crisis, for example, except for anticipating quite how profoundly home prices would drop, virtually all of the risks giving rise to the collapse of the market for securities backed by subprime mortgages appear to have been disclosed.[53] Investors did not, however, always appreciate these risks, in large part because the complexity of these securities made the risks very difficult to understand.[54] The prospectus itself in a typical offering of these securities can be hundreds of pages long.[55] Searching through this vast volume of "information" is to some extent akin to the difficulty that would be posed by searching the Internet without a search engine to systematically filter through and organize results.

Investment analysts thus often resort to simplifying heuristics, such as credit ratings, as substitutes for attempting to fully understand the investments being analyzed.[56] In the subprime crisis, for example, "A lot of institutional investors bought securities substantially based on their ratings [without fully understanding what they bought], in part because the market has become so complex."[57]

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52. Steven L. Schwarcz, *Disclosure's Failure in the Subprime Crisis*, 2008 UTAH L. REV. 1109, 1114 (2008) [hereinafter Schwarcz, *Disclosure's Failure*].

53. *But cf.* Mark Adelson & David Jacob, Adelson & Jacob Consulting, *ABS/MBS Litigation Outlook*, Nov. 19, 2007, http://adelsonandjacob.com/pubs/Litigation_Outlook.pdf (arguing that "disclosure materials generally did not highlight the [aggressive marketing of] stated-income loans to W-2 wage earners . . . . [T]he changing character of the stated-income loans (i.e., more wage earners) generally was not [disclosed]. . . . Issuers routinely disclosed that they allowed exceptions to their subprime mortgage underwriting criteria. However, they did not generally indicate whether the prevalence of these exceptions was increasing during the relevant period.").

54. COUNTERPARTY RISK MGMT. POLICY GROUP III, CONTAINING SYSTEMIC RISK: THE ROAD TO REFORM 53 (2008) [hereinafter CRMPG III REPORT] ("[T]here is almost universal agreement that, even with optimal disclosure in the underlying documentation, the characteristics of [several classes of securities] were not fully understood by many [large integrated financial intermediaries, hedge funds, specialized financial institutions, and other] market participants.").

55. The disclosure documents ordinarily consist of a prospectus and a prospectus supplement, each close to 200 pages long. Steven L. Schwarcz, *Disclosure's Failure in the Subprime Mortgage Crisis*, 2008 UTAH L. REV. 1109, 1110.

56. Investment managers who are compensated by the number or amount of securities recommended for investment may be especially tempted to do this, particularly if the securities being recommended are of a type that others are recommending. Schwarcz, *Disclosure's Failure*, *supra* note 52, at 1115. *Cf.* Shah & Oppenheimer, *supra* note 50, at 207 (explaining results of behavioral psychology experiment demonstrating that individuals increasingly employ heuristics to reduce the cost of analysis when time pressures or opportunity costs are high).

57. Aaron Lucchetti & Serena Ng, *Credit and Blame: How Rating Firms' Calls Fueled Subprime Mess*, WALL ST. J., Aug. 15, 2007, at A1 (quoting a market observer); *see also* Alan S. Blinder, *Six Fingers of Blame in the Mortgage Mess*, N.Y. TIMES, Sept. 30, 2007, at B4 (arguing that mortgage-backed securities, especially CDO securities, "were probably too complex for anyone's good"); Aaron

Although the use of heuristics might be efficient overall in certain applications, heuristic reasoning can sometimes expose analysis to bias and systematic error.[58] In the context of securities disclosure, exclusive reliance on ratings ignores the additional information that is essential to a truly competitive market in financial information.[59]

Complexities of Securities Can Obfuscate Consequences. When securities are highly complex, parties reviewing, or even structuring, the securities may not always appreciate all the consequences.[60] In the subprime crisis, for example, although ABS CDO transactions were backed by what appeared to be significantly diverse securities, there was an "underlying correlation in the subprime mortgage loans backing" many of those securities.[61] Not even rating agencies saw this correlation.[62] Although, in retrospect, one may say the correlation should have been realized, hidden correlations are only observable when there is full appreciation of the underlying variables.[63]

For example, during the late 1970s and early 1980s, investors failed to recognize an underlying correlation between mobile-home loans and the price of oil. An oil boom in Oklahoma drew an influx of oil workers,

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Lucchetti, Kara Scannell & Craig Karmin, *SEC Aims to Rein In the Role of Ratings*, WALL ST. J., June 24, 2008, at C1 ("The dirty secret of some bond investors is that they simply bought securities with the highest yield for a given rating, which is why they snapped up complicated securities tied to subprime mortgages.").

58. M. GRANGER MORGAN & MAX HENRION, UNCERTAINTY: A GUIDE TO DEALING WITH UNCERTAINTY IN QUANTITATIVE RISK AND POLICY ANALYSIS 102 (1990); Christine Jolls, Cass R. Sunstein & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1777 (1998).

59. *Cf.* Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 714 (2006) (arguing that a precise understanding of financial-market investments is essential to a truly competitive market).

60. *Cf.* Hu, *supra* note 3, at 1480 (observing in a derivatives context that "[t]he complexity can overwhelm even experts"). A related concern arises to the extent securities become so highly complex that, as Professor Kenneth Klee has suggested, parties sometimes have difficulty understanding their documentation. Kenneth Klee, Remarks at the International Insolvency Institute's Eighth Annual International Insolvency Conference (June 10, 2008) (notes on file with author).

61. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 403.

62. *Id.* Rating agencies make their business in carefully assessing the creditworthiness of investment securities. *See generally* Steven L. Schwarcz, *Private Ordering of Public Markets: The Rating Agency Paradox*, 2002 U. ILL. L. REV. 1, 6 [hereinafter Schwarcz, *Private Ordering of Public Markets*].

63. The limitations of cognitive complexity may help to explain the inability of even financial analysts and other "experts" to see these correlations. Recall that different people perceive the same phenomena on different levels of complexity. *See supra* note 13. As the complexity of financial products increased, fewer analysts possessed sufficiently nuanced cognition to properly understand and price the products. Trying to do their jobs, many analysts made oversimplifications usually on the optimistic side because the economy was expanding. To some extent, these simplifications involved overreliance on heuristics. *See supra* note 56 and accompanying text.

creating the nation's fastest growing market for mobile-home loans. When oil prices crashed, drilling in Oklahoma ceased, resulting in massive unemployment and causing widespread defaults on the mobile-home loans.[64]

The loan servicing problem likewise results from the complexity of securities obfuscating consequences.[65] Parties did not anticipate that the separate allocation of cash flows deriving from principal and interest to different investor tranches of mortgage-backed securities would lead, in a default scenario, to conflicts among investors. That, in turn, made servicers reluctant to exercise the discretionary judgment needed to restructure the underlying mortgage loans—since exercising any discretion might expose servicers to liability.[66]

The complexities of securities also can obfuscate consequences when payoffs on the securities are linked to unrelated events. Due to nonlinearity found in complex systems, small events can cause seemingly unrelated catastrophes as when a simple clogged pressure-release valve escalated into a meltdown at the Three Mile Island nuclear reactor.[67] Similarly in financial markets, consequences can be obfuscated when, for example, options or other derivative instruments have payoffs that are not linearly related to the prices of their underlying securities, so that information on day-to-day market movements cannot be used to predict the payoff if the market moves dramatically.[68]

Finally, the complexities of securities can obfuscate consequences when trying to assess investment risk. Investment analysts may well be able to intuit this risk, but—with limited time available to devote to risk assessment—a firm's senior managers often want risk to be modeled and reduced to useable numbers.[69] Any model, however, can be manipulated. For example, VaR, or value-at-risk, is presently the most widely used model for reducing investment risk to a number.[70] As the VaR model became more accepted, banks began compensating analysts not only for

64. Paul Bennett, NYSE Group, Effective Monetary Policy in the U.S. and Emerging Markets, Istanbul Bilgi University 5–8 (Sept. 2006) (unpublished manuscript, on file with author) (discussing that "factors" that remain unchanged for long periods can obscure correlation).

65. *See infra* notes 271–74 and accompanying text.

66. *See infra* note 274 and accompanying text (discussing "tranche warfare").

67. Richard Bookstaber, *The Myth of Non Correlation*, INSTITUTIONAL INVESTOR, Sept. 2007, at 82, 82.

68. RICHARD BOOKSTABER, A DEMON OF OUR OWN DESIGN: MARKETS, HEDGE FUNDS, AND THE PERILS OF FINANCIAL INNOVATION 156 (2007). My work in this Article is inspired in part by this excellent book.

69. Joe Nocera, *Risk Mismanagement*, N.Y. TIMES, Jan. 4, 2009, § 6 (Magazine), at 24.

70. *Id.* at 26.

generating profits but also for generating profits with low risks, measured by VaR.[71] Analysts therefore began to refocus investment portfolios to concentrate more on securities (such as MBS and credit-defaults swaps) that generate gains but only rarely have losses.[72] Because the likelihood of these losses was less than the risk percentages taken into account under VaR modeling—which typically excludes losses that have less than a one-percent (or, in some cases, five-percent) likelihood of occurring within the model's limited time frame—such losses were not included in the VaR computations.[73] Analysts knew but did not always make clear to senior management that in the rare cases where such losses occurred, they would be huge.[74]

Complexities of Securities Can Make Financial Markets More Susceptible to Financial Contagion. The complexities of securities can make financial markets more susceptible to financial contagion. In the subprime crisis, the complexities of securities made it easier for problems with subprime mortgage-backed securities to quickly infect the securitization and other credit markets generally. Investors did not always understand how CDO and ABS CDO securities worked, and therefore were prone to rely, in their investment decisions, on the fact that tranches of those securities were rated "investment grade" by such top rating agencies as Standard & Poor's, Moody's, and Fitch.[75] When those investment-grade tranches later lost money,[76] the resulting uncertainty caused investors to panic, fearing that other highly-rated securities could likewise default.[77]

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71. *Id.* at 46.

72. *Id.* For an explanation of credit-default swaps, *see infra* notes 130–33 and accompanying text.

73. Nocera, *supra* note 69, at 46. It is ironic that the VaR model explicitly excludes low probability events without regard to consequences of the events occurring, given Professor Hu's observation that ignoring such "threshold effects" is not always economically rational. Hu, *supra* note 3, at 1488.

74. Nocera, *supra* note 69, at 46.

75. Investment grade technically means a rating of BBB- or better. Schwarcz, *Private Ordering of Public Markets*, *supra* note 62, at 7. An investment-grade rating indicates that full and timely repayment on the securities should not be speculative. *See id.* at 7–8.

76. *See, e.g.*, Carrick Mollenkamp & Serena Ng, *Wall Street Wizardry Amplified Credit Crisis*, WALL ST. J., Dec. 27, 2007, at A1 (reporting on the downgrade of one CDO's AAA rated tranches to junk status).

77. *See, e.g.*, Mortimer B. Zuckerman, *Preventing a Panic*, U.S. NEWS & WORLD REP., Feb. 11, 2008, at 63–64 (arguing that "the credit system has been virtually frozen" because "few people even know where the liabilities and losses are concentrated"). In economic terms, this can be seen as a variant on adverse selection. *Cf.* Edward L. Glaeser & Hédi D. Kallal, *Thin Markets, Asymmetric Information, and Mortgage-Backed Securities*, J. FIN. INTERMEDIATION, Jan. 1997, at 64–65 (describing a common adverse selection problem within mortgage-backed securities: that issuers of

The complexities of securities also can make market problems more contagious. In the subprime crisis, for example, payment on many mortgage-backed securities was guaranteed by "monoline" insurers, or specialized financial insurance companies that guarantee principal and interest payments to investors on certain structured-finance and municipal securities. Monoline insurers traditionally have been thinly capitalized, the justification being that they use statistical models to stress-test every potential scenario and insure only securities that pass these tests.[78] In the subprime crisis, however, monolines did not always adequately stress-test for the scenario of rapidly falling house prices; as a result, they were weakened by having to make payments on defaulting securities far exceeding their projections. This caused some monolines to lose their rating-agency required capital cushions and, thus, their AAA ratings, which in turn caused many monoline-guaranteed securities to lose their ratings.[79] Because of uncertainty as to which securities were guaranteed by monolines and the inherent complexity of the monoline statistical rating scheme, some investors avoided any type of securities that were customarily guaranteed by monolines, even those with fundamental underlying strength.[80]

This is well exemplified by the resulting crisis in the auction-rate-note (ARN) market. ARNs are long-term debt securities with short-term resetting interest rates issued by municipalities, museums, schools, and similar entities.[81] Many ARNs are guaranteed by monoline insurers.[82] In February 2008, however, investors were able to find few buyers for their notes because potential buyers feared that the monolines, which also were

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mortgage-backed securities have greater familiarity with the product and special information regarding its quality); George A. Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q. J. ECON. 488, 488 (1970) (describing the agency costs that arise in the common situation where sellers have better information regarding the quality of a good than the buyers; and discussing that when buyers use some statistic or rating to judge quality, overall quality for goods might decline as the benefits of quality accrue to the statistical group rather than an individual seller).

78. *A Monoline Meltdown?*, ECONOMIST, July 28, 2007, at 77.

79. David Enrich & Peter Eavis, *More Subprime Pain in Store—UBS Write-Downs, Insurer Downgrades Point to More Unraveling*, WALL ST. J., Jan. 31, 2008, at C2.

80. Aline Van Duyn & Gillian Tett, *Markets Assess the Costs of a Monoline Meltdown*, FIN. TIMES, Feb. 20, 2008, http://www.ft.com/cms/s/0/8d715b9e-dfe9-11dc-8073-0000779fd2ac.html.

81. Liz Rappaport & Kara Scannell, *Auction-Rate Turmoil Draws Watchdogs' Scrutiny*, WALL ST. J., Feb. 22, 2008, at C2.

82. *The State of the Bond Insurance Industry: Hearing Before the H. Subcomm. on Capital Mkts., Ins., and Gov't Sponsored Enters. of the H. Comm. on Fin. Servs.*, 110th Cong. 39 (2008) (statement of Erik R. Sirri, Director, Division of Trading and Markets, U.S. Securities and Exchange Commission).

insuring large amounts of securities backed by subprime mortgages, would default. Buyers started avoiding all ARNs, even those of strong issuers.[83]

The complexities of securities also can contribute to contagion insofar as securities are so specialized and sophisticated that they have no actual or active trading market. Absent market valuation, these securities are typically valued by using highly complex mathematical models, a valuation procedure sometimes called "marking to model."[84] Like all mathematical models, the models for valuing securities are based on assumptions.[85] If these assumptions turn out to be wrong, investors may lose confidence in the securities. This occurred, for example, in the subprime crisis where the assumptions underlying mark-to-model valuation of CDO and ABS CDO securities turned out to be wrong, triggering panic among investors who did not (and, in the absence of a trading market or a reliable model, could not) know what those securities were worth.[86]

Complexities of Securities Can Make Financial Markets More Susceptible to Fraud. Complexity also can facilitate fraud, especially in the case of complex asset-backed securities transactions.[87] To understand why, compare asset-backed securities with ordinary corporate debt securities, like bonds. When a company issues bonds, investors purchase the bonds based on the company's ability to repay, which turns on the company's public reputation for financial integrity and governance.[88] Although there certainly have been frauds—like Parmalat, WorldCom,

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83. *See, e.g.*, Ted Phillips, *Moody's Warns of Negative Impacts from Auction-Rate Securities*, THE BOND BUYER, Feb. 21, 2008, at 4 (observing that failed auctions are "occurring in spite of the fact that the underlying credit quality of issuers remains strong").

84. Neil Shah, *Can Wall Street be Trusted to Value Risky CDOs?*, REUTERS, July 14, 2007, http://www.reuters.com/article/reutersEdge/idUSN0929430320070714.

85. *Id.* (detailing comments by M.I.T. Finance Professor Andrew Lo explaining that models used to value illiquid assets can "[break] down rather dramatically during abnormal times" because the assumptions underlying the models fail).

86. *See, e.g.*, Floyd Norris, *Reading Write-Down Tea Leaves*, N.Y. TIMES, Nov. 9, 2007, at C1 (discussing the problems related to using valuation models). *See generally* Ingo Fender & John Kiff, *CDO Rating Methodology: Some Thoughts on Model Risk and Its Implications* (Bank for International Settlements, Working Paper No. 163, 2004), *available at* http://www.bis.org/publ/work163.htm (discussing the problems associated with the valuation models used by rating agencies).

87. *See supra* note 44 and accompanying text (defining asset-backed securities).

88. *Cf.* Hollis Ashbaugh-Skaife, Daniel W. Collins & Ryan LaFond, *The Effects of Corporate Governance on Firms' Credit Ratings*, 42 J. ACCT. & ECON. 203, 238 (2006) (finding that weak corporate governance results in poorer credit ratings); TECHNICAL COMMITTEE, THE INT'L ORG. OF SECS. COMM'NS, THE ROLE OF CREDIT RATING AGENCIES IN STRUCTURED FINANCE MARKETS: FINAL REPORT 4 (2008), http://www.iosco.org/library/pubdocs/pdf/IOSCOPD270.pdf (finding that credit rating agencies examine a firm's financial stability in determining the likelihood an issued security would be repaid).

and Global Crossing—where the reality belied the company's reputation,[89] reputation built up slowly is harder to fake. For example, a corporation's reputation for financial integrity is derived from actual earnings as reported through financial statements and corroborated by independent certified public accountants.[90] With increased personal responsibility placed on corporate managers by the Sarbanes-Oxley Act, it is difficult—at least for public companies—to feign financial integrity.[91] A corporation's reputation for governance derives from the quality of management, which is tested and built up over time by individual managers.[92] When companies lack a good public reputation, they find it difficult if not impossible to issue bonds in the capital markets.[93]

The use of asset-backed securities, however, enables even companies without good public reputations to obtain capital-market financing indirectly by using their financial assets. Because asset-backed securities transactions are designed to withstand even a bankruptcy of the company, investors rely less on the company's reputation and much more on the ability of the financial assets originated by the company to repay the securities.[94] Therefore, much is done to monitor those assets.[95]

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89. *Cf.* David Simons, *WorldCom's Convincing Lies*, FORBES, July 8, 2002, http://www.forbes.com/2002/07/08/0708simons.html (discussing the fraudulent public reputation built by WorldCom that allowed it to sell bonds that were not based on the real value and reputation of the company).

90. Further, even the quality reputation of the auditing firm that verifies financial statements is widely believed to influence litigation exposure and the cost of raising capital. Inder K. Khurana & K. K. Raman, *Litigation Risk and the Financial Reporting Credibility of Big 4 Versus Non-Big 4 Audits: Evidence from Anglo-American Countries*, 79 ACCT. R. 473, 474 (2004).

91. Among other things, the Sarbanes-Oxley Act of 2002 requires corporate officers and similar managers to certify the accuracy and completeness of each annual report, and to certify that internal controls are in place such that managers and auditors are apprised of material information relating to the issuer and its subsidiaries. 69 AM. JUR. 2d *Securities Regulation* § 454 (2008).

92. David Hirshleifer, *Managerial Reputation and Corporate Investment Decisions*, 22 FIN. MGMT. 145, 146 (1993) (explaining that investor beliefs about manager and firm reputation influence the cost of raising capital, recruiting employees, and marketing products).

93. *See supra* note 88 and accompanying text (because many investors are limited to only bonds that carry investment-grade ratings, a poor reputation that results in poor credit ratings will restrict a firm's access to capital).

94. *See* SCHWARCZ, STRUCTURED FINANCE, *supra* note 47, § 3:1.

95. Query the extent to which the acceptability of this monitoring derived from traditional asset-backed (sometimes called asset-based) finance. To that extent, there may be a disconnect because traditional asset-backed finance dealt with collateral for loans, but the company was still important because if it went bankrupt there would be an automatic stay and other bad consequences for the asset-backed lender. *See, e.g.*, Steven L. Schwarcz, *The Easy Case for the Priority of Secured Claims in Bankruptcy*, 47 DUKE L.J. 425, 455–58 (1997) (discussing how bankruptcy impacts secured creditors). These same monitoring techniques may have carried over into bankruptcy-remote asset-backed securities transactions, such as securitization.

For example, under existing best-practice standards for monitoring,[96] one or more of the underwriters, trustees (or similar agents acting on behalf of the investors), and servicers of the asset-backed securities (hereinafter referred to as the "due-diligence parties") will engage in the following due diligence procedures.[97]

Before the asset-backed securities transaction is actually closed, the due-diligence parties typically review audited financial statements of the company certified as complying with generally accepted accounting standards. They also typically visit the company's offices to meet with management and to discuss applicable servicing practices, collections practices, and credit underwriting practices for the financial assets. The due-diligence parties then review data provided by the company examining, among other things, a random sampling of the actual underlying financial-asset files.[98] They will then contact the obligors listed in the files to confirm the existence of those financial assets. Additionally, they will review the company's reports of the historical and anticipated default rates on the underlying financial assets and try to ascertain that these rates are generally within the range of rates reported publicly for defaults on these types of financial assets.[99]

On an ongoing basis after the transaction closes, the servicer will prepare periodic, usually monthly, servicer reports on the continuing performance of the financial assets. This report typically includes data

96. The Securities Act of 1933, 15 U.S.C. §§ 77(a)–77(b) (2006) (the "Securities Act"), imposes on underwriters civil liability for misstatements or omissions in the registration statement. 15 U.S.C. § 77k(a)(5). The statutory standard to establish due diligence defense is "that required of a prudent man in the management of his own property." 15 U.S.C. § 77k(c). The statutory standard was further elaborated by the SEC in Rule 176 (a multifactor test). 17 C.F.R. § 230.176 (2009). *Escott v. BarChris Construction Corp.*, 283 F. Supp. 643 (S.D.N.Y. 1968), is the leading case on due diligence defense. *See, e.g.*, William K. Sjostrom, *The Due Diligence Defense Under Section 11 of the Securities Act of 1933*, 44 BRANDEIS L.J. 549, 549 (2006).

97. Sometimes, the due-diligence parties themselves look to independent third-party industry experts to perform a portion of this diligence on their behalf. *See, e.g.*, Robert W. Doty, Issuer Due Diligence—Relying on Experts & Third Party Information, Presentation to California Debt & Investment Advisory Commission, 6th Annual Pre-Conference (Sept. 10, 2007), *available at* http://www.treasurer.ca.gov/Cdiac/seminars/slides/20070910/doty.pdf.

98. It is usual to review only a random sampling where, as is customary, there are numerous small financial assets. Kathleen C. Engel & Patricia A. McCoy, *Turning a Blind Eye: Wall Street Finance of Predatory Lending*, 75 FORDHAM L. REV. 2039, 2083 n.214 (2007) (quoting Bill Shepherd, *Perils and Phantasm: The Mortgage Securitization Boom Is Threatened by Recession, Legislation and Rate Change*, INVESTMENT DEALERS DIG., Feb. 3, 2003, at 4 ("When subprime RMBS [residential mortgage-backed securities] underwriters examine loan files manually, normally they 'don't do due diligence on every single loan in a pool; at most, they do a random sample of, say, 3% of the loans.'").

99. *See, e.g.*, Bulletin from Kathryn E. Dick, Director, Treasury and Market Risk Division, Office of the Comptroller of Currency, Unsafe and Unsound Investment Portfolio Practices (May 22, 2002), http://www.occ.treas.gov/ftp/bulletin/2002-19.txt.

regarding payments received on the financial assets, principal amounts that had defaulted, and the status of various reserves. Because the company itself or one of its affiliates usually acts as the servicer,[100] the servicer report will be reviewed by one or more independent due-diligence parties (usually the trustee) who may even try to verify certain data such as checking payment receipts on the financial assets against what is being reported as collected. To the extent there are any problems in performance of the financial assets or discrepancies between reported and actual data, the company will be contacted to understand why. Significant problems or discrepancies usually will trigger a termination of the transaction.[101]

These due-diligence procedures are formidable but, for two reasons, they are not foolproof: they do not micromanage all uses and sources of cash, and (as mentioned) the servicer is not usually independent of the company.[102] In the recent Student Finance Corporation ("SFC") fraud, for example, to disguise very high default rates on financial assets consisting of tuition-payment loans, SFC itself made payments on those loans from the proceeds of new securitization transactions—in effect, engaging in an undisclosed Ponzi scheme.[103] All of the due-diligence procedures described above had been performed, yet the fraud remained undiscovered for years.[104] In another recent fraud where (again) these due-diligence procedures had been performed, the company is alleged to have misled the due-diligence parties and investors by depositing money into the collection account on the monthly date that collections were actually tested and then withdrawing the money the day after.[105] Existing best-practice monitoring standards thus imperfectly protect investors from fraud.

The foregoing discussion has focused on failures resulting from the complexities of modern securities and their underlying assets. This Article next discusses how the complexities of modern financial markets themselves can exacerbate these failures.

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100. *Cf.* SCHWARCZ, STRUCTURED FINANCE, *supra* note 47, § 4:5, at 4–10 (Schwarcz observes that companies usually perform their own servicing in asset-backed securities transactions due to the cost of delegating servicing responsibility.).

101. *See, e.g.*, DEBORAH R. SEIFE ET AL., FITCH RATINGS, ASSET-BACKED COMMERCIAL PAPER EXPLAINED 10 (2001), www.stern.nyu.edu/~igiddy/ABS/fitchabcp.pdf (explaining "transaction-specific" wind-down triggers, including breach of representation by a seller or servicer and deterioration of portfolio assets).

102. *See supra* notes 99–101 and accompanying text.

103. *In re* Commercial Money Ctr., Inc. Equip. Lease Litig., No. 1:02CV16000, 2006 U.S. Dist. LEXIS 21392 at *31–32 (N.D. Ohio Apr. 20, 2006) (citing MBIA Ins. Corp. v. Royal Indem. Co., 286 F. Supp. 2d 347, 349–55 (D. Del. 2003)).

104. MBIA Ins. Corp., 286 F. Supp. 2d 348, 350–51.

105. Complaint, Royal Indem. Co. v. Pepper Hamilton LLP, No. 05-165-JJF (D. Del. Mar. 18, 2005) (relating to the Student Finance Corporation fraud).

C. Complexities of Modern Financial Markets

The complexities of modern financial markets can aggravate the failures discussed above, in part because of the information uncertainty and the high sensitivity of markets to information. Financial markets rely critically on the supply of liquidity in the form of credit.[106] The ability to contract for credit, in turn, depends on information not only about the economic health of the party seeking credit and its ability to repay ("counterparty risk") but also about how the structure of the credit transaction more generally exposes the parties to risk.[107]

One way in which markets per se create information uncertainty is the "indirect-holding system" under which virtually all debt and equity securities are presently traded, with intermediary entities holding securities on behalf of investors. Issuers of the securities generally record ownership as belonging to one or more depository intermediaries, which, in turn, record the identities of other intermediaries (such as brokerage firms or banks) that buy interests in the securities. Those other intermediaries, then, record the identities of investors that buy interests in the intermediaries' interests.[108] This seemingly convoluted system has decisive advantages over a direct-holding system for securities: it reduces the costs of record keeping and lowers the risk of loss occasioned by physically transferring securities.[109] Inadvertently, however, the indirect-holding system exacerbates uncertainty by reducing transparency: third parties cannot readily determine who ultimately owns, and thus has credit exposure to, specific securities because there is no single location from which third parties can easily get that information.[110]

Furthermore, investors and other market participants often apply highly sophisticated mathematical techniques to attempt to quantify market information. Although this often can increase investment precision, it sometimes can backfire. Professors Khandani and Lo have hypothesized, for example, that the subprime crisis resulted, at least in part, from a convergence in hedge-fund quantitatively constructed investment strategies. They argue that when a number of hedge funds experienced unprecedented losses during the week of August 6, 2007, the hedge funds

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106. MEIR KOHN, FINANCIAL INSTITUTIONS AND MARKETS 727 (1994); JOSEPH STIGLITZ & BRUCE GREENWALD, TOWARDS A NEW PARADIGM IN MONETARY ECONOMICS 142 (2003).

107. STIGLITZ & GREENWALD, *supra* note 106, at 142–43.

108. *See* Steven L. Schwarcz, *Intermediary Risk in a Global Economy*, 50 DUKE L.J. 1541, 1547–48 (2001).

109. *Id.* at 1549.

110. *Id*. at 1583.

rapidly unwound sizable portfolios—likely based on a multi-strategy fund or proprietary-trading desk.[111] This unanticipated correlation of initial losses[112] then caused further losses by triggering stop/loss and de-leveraging policies.[113]

Regardless of the extent that the subprime crisis might have resulted from a convergence in quantitatively constructed investment strategies, the very existence of these strategies points out a broader potential to aggravate failure. Investments in financial markets are so tied to mathematical strategies that particular events can formulaically trigger massive sell-offs without parties having the time or opportunity to exercise judgment. This tight coupling of financial markets is itself a serious risk factor.[114]

Information uncertainty, whatever its source, is especially dangerous when combined with nonlinear feedback effects and tight coupling[115]—a combination which inadvertently can be created or exacerbated by regulation.[116] This is perhaps best exemplified by mark-to-market, or "fair value," accounting. In its simplest form, this is the common regulatory requirement[117] that a securities account be adjusted in response to a change in the market value of the securities. An investor, for example, may buy securities on credit from a securities broker-dealer, securing the purchase price by pledging the securities as collateral. To guard against the price of the securities falling to the point where their value as collateral is insufficient to repay the purchase price, the broker-dealer requires the investor to maintain a minimum collateral value. If the market value of the securities falls below this minimum, the broker-dealer will issue a "margin call" requiring the investor to deposit additional collateral, usually in the form of money or additional securities, to satisfy this minimum. Failure to

111. Amir Khandani & Andrew W. Lo, *What Happened to the Quants in August 2007?* (Sept. 20, 2007), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1015987&download=yes.

112. *See supra* notes 60–64 and accompanying text.

113. Khandani & Lo, *supra* note 111, at 1.

114. *See supra* note 16 and accompanying text.

115. Nonlinearity results when "interactions among components of a system are not directly proportional." Virginia R. Burkett et al., *Nonlinear Dynamics in Ecosystem Response to Climactic Change: Case Studies and Policy Implications*, 2 J. ECOLOGICAL COMPLEXITY 357, 359 (2005).

116. BOOKSTABER, *supra* note 68, at 146 ("[T]he natural reaction to [financial] market breakdown is to add layers of protection and regulation. But trying to regulate a market entangled by complexity can lead to unintended consequences, compounding crises rather than extinguishing them because the safeguards add even more complexity, which in turn feeds more failure.").

117. Accounting rules are a form of regulation, being promulgated (in the United States) by the Financial Accounting Standards Board pursuant to its delegation of authority from the Securities and Exchange Commission. Financial Accounting Standards Board, Facts About FASB (2008), at 1, http://www.fasb.org/facts/facts_about_fasb.pdf (discussing this delegation of regulatory authority).

do so triggers a default, enabling the broker-dealer to foreclose on the collateral.[118]

Requiring investors to "mark to market" in this fashion is generally believed to reduce risk.[119] Nonetheless, it can cause "perverse effects on systemic stability" during times of market turbulence, when forcing sales of assets to meet margin calls can depress asset prices, requiring more forced sales (which, in turn, will depress asset prices even more), causing a downward spiral.[120] The existence of leverage makes this spiral more likely and amplifies it if it occurs.[121] At least some portion of the subprime crisis appears to have been caused by this downward spiral.[122]

Another way that the complexities of modern financial markets can aggravate failures is through human interactive behavior. When financial markets exhibit properties of a complex system, the ability to predict consequences, such as cause-and-effect explanations for market movements, is frustrated by nonlinear feedback effects arising from interactivities among market participants.[123] For example, just a few years ago, home prices were described as overinflated in many markets due partially to lax lending standards that artificially fuelled demand for higher priced homes.[124] At the same time, credit became increasingly available to

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118. ZVI BODIE, ALEX KANE & ALAN J. MARCUS, INVESTMENTS 71–72 (8th ed. 2008).

119. *See, e.g.*, Gikas A. Hardouvelis & Panayiotis Theodossiou, *The Asymmetric Relationship Between Initial Margin Requirements and Stock Market Volatility Across Bull and Bear Markets*, 15 REV. FIN. STUD. 1525, 1554–55 (2002) (finding a correlation between higher margin calls and decreased systemic risk, and speculating that higher margin calls may bleed the irrationality out of the market until only sound bets are left).

120. Rodrigo Cifuentes, Gianluigi Ferrucci & Hyun Song Shin, *Liquidity Risk and Contagion* 2 (Bank of Eng. Working Paper No. 264, 2005), *available at* http://www.bankofengland.co.uk/publications/workingpapers/wp264.pdf); *see also* Clifford De Souza & Mikhail Smirnov, *Dynamic Leverage: A Contingent Claims Approach to Leverage for Capital Conservation*, J. PORTFOLIO MGMT., Fall 2004, at 25, 28 (arguing that, in a bad market, short-term pressure to sell assets to raise cash for margin calls can lead to further mark-to-market losses for remaining assets, which triggers a whole new wave of selling, the process repeating itself until markets improve or the firm is wiped out; and referring to this process as a "Critical Liquidation Cycle").

121. De Souza & Smirnov, *supra* note 120, at 26–27.

122. Rachel Evans, *Banks Tell of Downward Spiral*, 27 INT'L FIN. L. REV. 16 (June 2008).

123. *See* NEIL F. JOHNSON, PAUL JEFFERIES & PAK MING HUI, FINANCIAL MARKET COMPLEXITY 4 (2003) (also describing this as the difficulty of distinguishing exogenous from endogenous factors); Thomas Lee Hazen, *The Short-Term/Long-Term Dichotomy and Investment Theory: Implications for Securities Market Regulation and for Corporate Law*, 70 N.C. L. REV. 137, 157 (1991) (observing that irrational investor behavior that interferes with market efficiency is sometimes referred to as "noise"). *Cf.* BOOKSTABER, *supra* note 68, at 156 (observing that when market participants have a self-interest in gaming the system, it is all the more likely that an unanticipated crisis will arise).

124. Ted Cornwell, *Merrill Lynch Sees Credit Concerns Persisting in Mortgage Arena*, NAT'L MORTGAGE NEWS, May 30, 2005, at 15 (describing comments by Merrill Lynch analyst Kenneth Bruce that mortgage borrowers were "overleveraged" and that "creative financing" was driving overinflated home prices).

less creditworthy borrowers as investors sought higher rates—arguably expecting home prices to continue to rise unabated.[125] The increasing availability of credit overinflated home prices even more, causing a greater- than-expected decline when the bubble burst.[126] In turn, this greater-than-expected decline in home prices not only caused mortgage owners to suffer higher-than-expected losses but also increased the rate of foreclosure, which itself further depressed home prices (causing mortgage owners to suffer even more).[127]

Another example of this nonlinear feedback effect is caused by the interactive nature of securities trading. Modern financial markets often feature quickly adapting participants trading in sophisticated securities. This can frustrate stability—resulting in positive feedback loops and a failure of arbitrage price correction—when participants trade as much in reaction to the expected behavior and strategy of others as on their own information and analysis.[128] An extreme form of this phenomenon can occur when investors make their investment decisions by anticipating what other investors will do.[129]

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125. Tom Petruno, *Cheap Loans are Under Fire: Mortgage Companies Are on the Defensive for Loosening Credit Standards Amid the Housing Boom*, L.A. TIMES, Sept. 18, 2005, at C1, C4 (explaining that mortgage lenders continued to loosen credit standards to insure fee income and higher rates amid Fed rate hikes and skyrocketing home prices); *see also* David Streitfeld, *It's Not a Bubble Until it Bursts: Although Ignoring Real Estate Bears Has Been Profitable Lately, Doom is Again on Some Lips*, L.A. TIMES, May 29, 2005 (describing participants in real estate markets as making investment decisions based primarily on their predictions of the behavior of other participants—namely mortgage lenders and home buyers).

126. *The Fed's Alibi*, WALL ST. J., Sept. 17, 2007, at A16 ("The Fed's easy money policies helped cause the housing bubble and subprime crisis . . . .").

127. Justin Lahart, *Summer's Woes May Be Felt for Some Time*, WALL ST. J., Aug. 22, 2007, at C1 (observing that a dramatic tightening of standards by purchasers in the secondary mortgage market, after "rising default rates . . . led to steep losses" to mortgage owners).

128. *See* Lisa R. Anderson & Charles A. Holt, *Information Cascades in the Laboratory*, 87 AM. ECON. REV. 847, 847 (1997) (describing experimental results involving an "information cascade" in which it is more "rational" for an individual to follow the decisions of others than to act on private information and analysis; this information cascade continues until some later player recognizes what has happened and deviates); Erik F. Gerding, *Laws Against Bubbles: An Experimental-Asset-Market Approach to Financial Regulation*, 2007 WIS. L. REV. 977, 984 (arguing that experimental asset markets are effective tools to evaluate the effectiveness of laws designed to limit market imperfections such as asset price bubbles in the context of complex adaptive markets); Schwarcz, *Rethinking the Disclosure Paradigm*, *supra* note 48, at 4–5 (explaining that fund managers might still trade with an irrational herd rather than seizing the arbitrage opportunity because managers face greater scrutiny for betting against a herd, have finite employment horizons, and have investment expertise that rapidly depreciates in evolving financial markets); *supra* note 14 and accompanying text (noting that volatility and illiquidity can result from interactive behavior within markets).

129. *See, e.g.*, James Surowiecki, *Everyone's Watching*, NEW YORKER, Nov. 10, 2008, at 35 (observing that, "in an environment of profound uncertainty [as has happened in the subprime crisis], investors have a natural if troubling tendency to turn to [futures markets for, and foreign markets in, the same types of securities] as horoscopes," thereby turning "investing [into] an exercise in

Finally, the complexities of modern financial markets can aggravate failures through the interconnectedness of market participants. Financial institutions are often connected with one another through—and in that capacity, are characterized as "counterparties" to—derivatives contracts.[130] These financial instruments, most notably credit-default swaps (CDS),[131] are used by institutions to hedge against the risk on their own investments.[132] Institutions sometimes also use them to earn fees for insuring risk on another party's investments.[133] Because of these interconnecting contracts, bankruptcy or other failures of a given market participant can cause that participant to default on its obligations to other market participants, who in turn—if the obligations in default are large enough—might default on their own obligations to market participants, leading to a domino-effect collapse.[134] Counterparty risk—essentially an information failure caused by lack of transparency as to counterparty financial condition—is further complicated by the lack of a formal trading system for these types of derivatives, which are simply contracts between private parties.[135] The inability of market participants to know how much contingent exposure another participant might have on these contracts increases the uncertainty.

These risks came to a head with the Federal Reserve bailouts of Bear Stearns and AIG. Bear Stearns, for example, had a subsidiary hedge fund which was believed to hold a large mortgage-backed securities portfolio of uncertain value.[136] At the same time, that subsidiary appeared to have

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anticipating what other investors will do"; and also arguing that this tendency "can easily lead to contagion [because] selling in one market triggers selling in the next").

130. PHELIM BOYLE & FEIDHLIM BOYLE, DERIVATIVES: THE TOOLS THAT CHANGED FINANCE 7 (2001) (defining parties to a contract, especially a derivatives contract, as "counterparties").

131. In a credit-default swap, one party (the credit "seller") agrees, in exchange for the payment to it of a fee by a second party (the credit "buyer"), to assume the credit risk of certain debt obligations of a specified borrower or other obligor. If a "credit event" (for example, default or bankruptcy) occurs in respect of that obligor, the credit seller will either (a) pay the credit buyer an amount calculated by reference to post-default value of the debt obligations or (b) buy the debt obligations (or other eligible debt obligations of the obligor) for their full face value from the credit buyer. SCHWARCZ, STRUCTURED FINANCE, *supra* note 47, § 10:3.1, at 10–16.

132. Frank Packer & Haibin Zhu, *Contractual Terms and CDS Pricing*, BIS Q. REV., Mar. 2005, at 89.

133. Well over 90% of derivatives contracts are currently credit-default swaps. *See, e.g.*, COMPTROLLER OF THE CURRENCY, OCC'S QUARTERLY REPORTS ON BANK DERIVATIVES ACTIVITIES 2009, http://www.occ.treas.gov/deriv/deriv.htm.

134. Schwarcz, *Systemic Risk*, *supra* note 3, at 198–200.

135. CDS transactions are presently "over the counter," meaning they are entered into contractually and not on an exchange.

136. *See, e.g.*, *Turmoil in U.S. Credit Markets: Examining the Recent Actions of Federal Financial Regulators, Panel I of the hearing of the Senate Banking, Housing, and Urban Affairs Committee*, Federal News Service, Apr. 3, 2008 (Statement of Senator Charles Schumer (D-NY) that

significant exposure to other market participants on CDS contracts.[137] The fear was that the subsidiary's assets would be insufficient to pay its liabilities on the CDS contracts.[138] Counterparty risk is also believed to be integral to the failure of credit markets in the subprime crisis.[139]

The Article next examines how failures resulting from complexity should be addressed.

III. ADDRESSING MARKET FAILURES RESULTING FROM COMPLEXITY

Complexity can add great efficiency and depth to financial markets, but it also can cause a multitude of market failures. These failures, however, fall into three broad categories: (A) failures, such as impaired disclosure, caused by information uncertainty; (B) failures, such as financial contagion and the inability to predict consequences, caused by nonlinearity and tight coupling; and (C) failures, such as moral hazard, servicer paralysis, and fraud, caused by conflicts and other forms of "misalignment." The causes of these failures are similar to those that engineers have long faced when working with complex systems that have nonlinear feedback effects.[140] Moreover, many characteristics of complex

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one of the reasons for Bear Stearns' failure was that "[t]wo of [Bear Stearns'] hedge funds went under due to mortgages in the summer").

137. *Cf.* Testimony of Ben Bernanke, Federal Reserve Chairman, before the House Financial Services Committee, *Transcript of the Semiannual Humphrey Hawkins Hearing on Monetary Policy of the House Financial Services Committee*, Federal News Service, July 16, 2008 ("Part of the reason that it was a big concern to us when Bear Stearns came to the brink of failure was that we were concerned that there were various markets where the failure of a major counterparty would have created enormous strains to the financial system.").

138. David Henry, *Wall Street's Perfect Storm: Investors Deal with a Lehman Bankruptcy, the Sale of Merrill Lynch to BofA, and a Possible AIG Restructuring*, BUS. WK., Sept. 15, 2008, http://www.businessweek.com/bwdaily/dnflash/content/sep2008/db20080914_860761.htm ("[Treasury Secretary Paulson and Federal Reserve Chairman Bernanke] feared permitting Bear Stearns' bankruptcy would throw Wall Street into chaos because Bear had untold credit derivatives contracts in place with countless other banks and hedge funds."). Netting and, to a growing extent, collateral agreements are used to mitigate counterparty credit risks. COMM. ON PAYMENT AND SETTLEMENT SYS. AND THE EURO-CURRENCY STANDING COMM. OF THE CENTRAL BANKS OF THE GROUP OF TEN COUNTRIES, BANK OF INTERNATIONAL SETTLEMENTS, REPORT ON OTC DERIVATIVES: SETTLEMENT PROCEDURES AND COUNTERPARTY RISK MANAGEMENT 1 (1998), http://www.bis.org/publ/ecsc08.htm. In the United States, recent bankruptcy law changes are intended to further mitigate this risk by preventing an institution from "cherry-picking" favorable contracts with its derivatives counterparties. Edward R. Morrison & Joerg Riegel, *Financial Contracts and the New Bankruptcy Code: Insulating Markets from Bankrupt Debtors and Bankruptcy Judges*, 13 AM. BANKR. INST. L. REV. 641, 642 (2005). These bankruptcy law changes, which apply to derivatives contracts, modify U.S. bankruptcy law under which entities in bankruptcy generally have the right to choose to continue with profitable contracts while terminating unprofitable contracts with the same counterparty. *Id.* at 642, 647, 660, 663.

139. Schwarcz, *Keynote Address*, *supra* note 3.

140. I make this observation not only based on my experience and expertise as a finance lawyer

engineering systems are similar to those of financial markets.[141] For these reasons, this Article will also take into account the "chaos theory" that helps to inform engineers about complex systems with nonlinear feedback effects.[142]

Of course, important differences exist between engineered systems and financial markets. Engineers and scientists often can perform real experiments, yielding results that may well be more precise than the results of empirical studies of financial markets. In part, this is because interactive market behavior—in which "banks, consumers, firms, . . .

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and professor but also as a former engineer. *Cf.* John Kambhu et al., *Systemic Risk in Ecology and Engineering*, 13 FRBNY ECON. POL'Y REV. 25, 25 (2007) ("Several fields of engineering and science share with economics a keen concern with systemic risk."); Joseph H. Sommer, *Commentary: Where is the Economic Analysis of Payment Law?*, 83 CHI.-KENT L. REV. 751 (2008) (arguing that engineering principles apply to analyzing the law of payment systems).

141. Hsieh, *Chaos and Nonlinear Dynamics*, *supra* note 19. Financial markets originally were modeled as linear systems. The efficient capital market hypothesis (EMH), for example, posits that "the market prices securities *as if* there was a rational process, whether or not the market's constituent actors qualify as rational." Donald C. Langevoort, *Theories, Assumptions, and Securities Regulation: Market Efficiency Revisited*, 140 U. PA. L. REV. 851, 852 (1992). Another model, the random walk theory, is effectively a subset of the EMH because it "maintains that the market is efficient, with prices moving so rapidly in response to new information that investors cannot consistently buy or sell fast enough to benefit." Thomas Lee Hazen, *The Short-Term/Long-Term Dichotomy and Investment Theory: Implications for Securities Market Regulation and for Corporate Law*, 70 N.C. L. REV. 137, 157 (1991). It is questionable, however, whether the EMH validly describes markets for complex securities, since many legitimate transactions in which securities are issued are "so complex that less than a critical mass of investors can understand them in a reasonable time period [and to that extent] the market will not reach a fully informed price equilibrium, and hence will not be efficient." Schwarcz, *Rethinking the Disclosure Paradigm*, *supra* note 48, at 19. Moreover, the EMH does not appear to validly describe markets for debt securities. Even publicly-traded debt markets are not efficient. *See, e.g.*, Yedidia Z. Stern, *A General Model for Corporate Acquisition Law*, 26 J. CORP. L. 675, 709 (2001) ("[S]tudies show that the bond market is not efficient; and therefore, one cannot expect the market prices to compensate bondholders for the risks to which they are exposed."). Privately traded debt markets may be even less efficient. Camden Asset Mgmt., L.P. v. Sunbeam Corp., No. 99-8275-CIV, at *31–36 (S.D. Fla. July 3, 2001) (stating that privately placed Rule 144A-exempt securities, being thinly traded, do not have an efficient market). It therefore is highly unlikely that the EMH validly describes markets for complex *debt* securities—the category that includes virtually all investment securities issued in securitization and other structured financing transactions, SCHWARCZ, STRUCTURED FINANCE, *supra* note 47, § 1:1, at 1–5, and all of the securities involved in the subprime crisis, Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 376.

142. *Cf.* Lawrence A. Cunningham, *From Random Walks to Chaotic Crashes: The Linear Genealogy of the Efficient Capital Market Hypothesis*, 62 GEO. WASH. L. REV. 546, 593 (1994) (arguing that markets are nonlinear systems because "deeper structural phenomena" than information about asset values affect market movements); Patrick J. Glen, *The Efficient Capital Market Hypothesis, Chaos Theory, and the Insider Filing Requirements of the Securities Exchange Act of 1934: The Predictive Power of Form 4 Filings*, 11 FORDHAM J. CORP. & FIN. L. 85 (2005) (discussing, in the context of the insider filings requirements of the securities laws, the extent to which chaos theory might inform financial market models). The disconnect between market prices and fundamental underlying asset values in the subprime crisis provided recent concrete evidence that financial markets have characteristics of nonlinear systems. *See infra* note 197. *Cf.* Glen, *supra* at 99 (observing that such a disconnect would signal nonlinearity).

investors [and other economic agents] continually adjust their market moves, buying decisions, prices, and forecasts to the situation these moves or decisions or prices or forecasts together create"—adds a "layer of complication . . . not experienced in the natural sciences" where reactions are simpler and more predictable.[143] Engineers also often enjoy the luxury of being able to stop and restart a system.[144] Nonetheless, with appropriate discretion, certain engineering insights translate robustly to financial-market analysis.

Recognizing that "apparently there are no general laws for complexity [and so] one must reach for 'lessons' that might, with insight and understanding, be learned in one system and applied to another,"[145] the analysis below explores potential ways that market participants and regulators can attempt to retain the financial-market efficiency, sophistication, and depth afforded by complexity while reducing the potential for its market failures.[146] Because these failures can cut across the specific factual patterns identified in Part II, the analysis is organized functionally by the nature of each failure, first addressing failures arising from uncertainty, then failures arising from nonlinear feedback and tight coupling, and finally failures resulting from conflicts and other forms of "misalignment" that result from complexity.[147]

A. Addressing Information Failures Arising from Uncertainty

Uncertainty can cause a variety of financial-market failures, most obviously impairing securities disclosure.[148] This impairment reflects the

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143. Arthur, *supra* note 18, at 107.

144. J. M. Ottino, *Engineering Complex Systems*, 427 NATURE 399, 399 (2004).

145. Nigel Goldenfeld & Leo P. Kadanoff, *Simple Lessons from Complexity*, SCIENCE, Apr. 2, 1999, at 87, 89 (predicting an increasing study of complexity "with a view to better understanding" economic as well as physical and biological systems).

146. One reviewer of this Article questions, as devil's advocate, whether the subprime crisis has upset the very conception that, absent market failures, unrestrained financial markets are efficient. Because I have argued that several types of market failures—including complexity—in fact contributed to the subprime crisis, *see supra* notes 3–4 and accompanying text, I see no justification for that extreme position.

147. This Article does not purport to cover all types of conflicts that could cause market failure, just those that result from complexity. For a more complete discussion of conflicts that could cause market failure, see generally Schwarcz, *Protecting Financial Markets*, *supra* note 1, and Steven L. Schwarcz, *Conflicts and Financial Collapse: The Problem of Secondary-Management Agency Costs*, 26 YALE J. ON REG. 457 (2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1322536 [hereinafter Schwarcz, *Conflicts and the Financial Collapse*].

148. *See supra* notes 48–57 and accompanying text (discussing, among other things, that complexity increases the cost of analyzing and valuing securities, and that at some point the cost increase can exceed the benefit gained).

engineering principle that where a system or structure is complex, the abstractions and simplifications needed to make its problems approachable can introduce significant uncertainty.[149] Assumptions made in civil engineering, for example, introduce uncertainties when assessing the strength of buildings and their potential to collapse.[150] There are several potential ways to deal with this impaired disclosure: tolerate it, proscribe transactions with impaired disclosure or otherwise impose regulation attempting to reduce uncertainty, or implement supplemental protections to minimize the impairment.[151]

Toleration would not work because impaired disclosure makes securities markets inefficient.[152] Proscribing transactions with impaired disclosure would not work because it inadvertently would ban many beneficial transactions.[153] Complexity is not an end in itself but usually is a by-product of salutary goals such as seeking to transfer risk to parties better positioned to hold the risk and reducing the cost of funding businesses.[154] The harm averted by proscription would, therefore, likely exceed its benefits.[155]

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149. MORGAN & HENRION, *supra* note 58, at 47. Uncertainty also might indicate randomness, or an inability to quantify probability. *Id.* at 63 (discussing the Heisenberg uncertainty principle in quantum mechanics, which holds that it is possible to know either the location or the momentum of a particle, but observing one property makes it impossible to observe the other). Sometimes systems might appear random, however, because of an incomplete understanding of the underlying processes. *Id.*

150. *See* BILAL M. AYYUB, RISK ANALYSIS IN ENGINEERING AND ECONOMICS 28 (2003) (discussing fuzzy set theory as a method for addressing "[a]pproximations [that] arise from human cognition and intelligence . . . and result in uncertainty . . . .").

151. In engineering too, designers of systems must choose to tolerate, eliminate, or provide supplement protections against undesirable byproducts. *Cf.* Dinmukhamed Eshanov, *The Role of Multinational Corporations from the Neoinstitutionalist and International Law Perspectives: The Concept of the Three-Level Game*, 16 N.Y.U. ENVTL. L.J. 110, 122 (2008) (observing that despite growing evidence that chlorofluorohydrocarbons were creating a hole in the ozone layer, CFCs were not banned until a viable substitute was created); Nicholas A. Robinson, *Legal Systems, Decisionmaking, and the Science of Earth's Systems: Procedural Missing Links*, 27 ECOLOGY L.Q. 1077, 1108 (2001) (observing that the harmful exhaust produced as a byproduct by automotive internal combustion engines was tolerated because automobiles have become a transportation necessity but catalytic converters, which eliminate almost 90% of unwanted pollutants, were introduced as a supplemental protection).

152. Schwarcz, *Disclosure's Failure*, *supra* note 52, at 1116–17.

153. *Id.* at 1117–18.

154. *See supra* notes 6–10 and accompanying text. Even in Enron, complexity was not an end in itself but a (perhaps misguided) attempt to minimize financial-statement losses and volatility, accelerate profits, and avoid adding debt to its balance sheet which could have hurt Enron's credit rating and thereby damage its credibility in the energy trading business. Schwarcz, *Enron*, *supra* note 10, at 1309–10.

155. Schwarcz, *Disclosure's Failure*, *supra* note 52, at 1118. Efficiency demands that the costs of regulation do not exceed its benefits. *See* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW § 1.2, at 13–14 (4th ed. 1992) (discussing this "Kaldor-Hicks" standard as the operating standard of efficiency);

Other regulatory attempts to reduce uncertainty are also unlikely to work. Any such regulation would run into the conundrum that uncertainty can be irreducible, in that the abstractions and simplifications needed to make a complex system approachable can themselves introduce significant uncertainty.[156] For example, Professor Henry Hu has argued that regulators cannot keep up with development of complex derivatives products because academic publishing, in which such developments may first appear, "is not a timely regulatory tool," and also because most information about new financial products is not made public for competitive reasons.[157] To reduce this uncertainty, he considered the possibility of regulation that would institutionalize a "system of information gathering to cope with" ongoing financial innovation.[158] But such a system, he cautioned, could be costly, causing the possible "loss of valuable proprietary information" and tempting financial institutions "to follow regulator-approved models on pain of increased regulatory scrutiny."[159] Even worse, he concluded, regulators may not be sophisticated enough to interpret, and indeed may misinterpret, this information.[160]

Similarly, regulatory attempts to limit uncertainty by standardizing transactions and financial products would likely have unintended negative consequences.[161] Professor Gale has argued that investor unfamiliarity with new securities creates "an additional source of uncertainty which is not traceable to the randomness of the underlying asset returns."[162] Consistent with Gale, this Article has described how the complexities of securities involved in the subprime crisis created significant uncertainty.[163]

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accord, Louis Kaplow & Steven Shavell, *Fairness Versus Welfare*, 114 HARV. L. REV. 961, 1015 (2001). Cost-benefit balancing is also a well-recognized test for regulatory political viability. For example, before any major rule may take effect in the United States, regulatory agencies must submit a cost-benefit analysis to Congress. Congressional Review of Agency Rulemaking Act, 5 U.S.C.A. §§ 801–08 (2006). Although I believe that proscribing transactions with impaired disclosure would inadvertently ban many beneficial transactions, actual empirical cost-benefit balancing is often impossible for anything but a trivial problem. Guido Calabresi, *Transaction Costs, Resource Allocation, and Liability Rules—A Comment*, 11 J.L. & ECON. 67, 70 (1968). Ultimately, regulators must make best guesses regarding the efficacy of proposed actions. *Id*.

156. *See supra* note 149 and accompanying text.

157. *See* Hu, *supra* note 3, at 1499.

158. *Id.* at 1503, 1505–06.

159. *Id.* at 1508.

160. *Id.*

161. *Cf. supra* notes 115–17 and accompanying text (discussing unintended negative consequences of accounting regulation).

162. Douglas Gale, *Standard Securities*, 59 REV. ECON. STUD. 731, 734 (1992).

163. *See supra* Part II.B. In this context, it is somewhat ironic that securitization itself is a means of standardizing the underlying assets, securitized assets being "more likely to be considered as a part of a standardized class of assets than any one specific mortgage would be." Hellwig, *supra* note 3, at

Regulation, though, is probably not the best way to address this uncertainty. Because market conditions change in real time and, thus, are more fluid than regulatory change, imposing standardization through law would block design innovations needed to adapt securities to changing markets. Standardization appears to be better achieved by market participants themselves—as would occur when investors charge uncertainty premiums.[164]

Implementing cost-effective supplemental protections, therefore, appears to be the best approach to the problem of impaired disclosure. These protections could include guaranties by sellers (such as warranties) and governmental and private-sector certifications of quality.[165]

In a limited sense, a form of seller "guaranty" is being considered for financial markets by having underwriters of securities disclose that they hold (and intend to continue to hold) exposure to pari passu or subordinate positions in the securities being sold. In this way, the underwriter puts "skin in the game" to signal its belief in the safety of the securities.[166]

This approach, however, can sometimes backfire.[167] In the subprime crisis, for example, underwriters customarily purchased some portion of the subordinated "equity" tranches of ABS CDO securities to demonstrate their belief in the securities being sold.[168] Unfortunately, at least some of these underwriters did not fully understand the risks associated with their

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13. Professor Hellwig has "serious doubts," however, about the second and higher tiers of securitization represented by CDO and ABS CDO securities. Even though these additional layers "will provide for additional risk diversification," their "benefits seem ephemeral [because investors could diversify with multiple MBS investments] and the potential incentive effects large [e.g., increasing the scope for moral hazard by further diluting incentives for institutions handling the MBS stage to actively control the quality of the mortgages they were packaging]." *Id*. at 23–24.

164. *Cf.* Gale, *supra* note 162, at 731 (arguing that investors will charge an "uncertainty premium" on unfamiliar securities). I do not know whether investors charged sufficient uncertainty premiums in the subprime crisis. Any failure to do so may well be due to the other market failures described in this Article, such as conflicts of interest. *See infra* notes 287–94 and accompanying text.

165. Schwarcz, *Disclosure's Failure*, *supra* note 52, at 1118–21.

166. Fitch Ratings Special Report, *Exposure Draft: Retaining Equity Piece Risk—Enhancing Transparency* 2 (June 24, 2008) (seeking market feedback as to whether to invite key transaction parties to disclose whether they retain economic risk in the securities being sold); *see also* EUROPEAN SECURITIES MARKET EXPERT GROUP, ROLE OF CREDIT RATING AGENCIES (June 2008) (recommending that rating agencies disclose information regarding an originator's or sponsor's retained interest in securities). These approaches are not, of course, true guaranties because investors would have no claim for losses. For a suggestion, albeit unrealistic, that true guaranties be used, see Daniel Andrews, *The Clean Up: Investors Need Better Advice on Structured Finance Products*, 26 INT'L FIN. L. REV. 14, 14 (2007).

167. Fitch, *supra* note 166, at 1 (there are "currently no data available to assess whether such retention or non-retention of equity piece risk actually has a greater impact on a transaction's performance").

168. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 381. *Cf.* Hellwig, *supra* note 3, at 16 ("As time went on, ever greater portions of equity tranches were sold to outside investors.").

retained tranches. This resulted in what can be called a "mutual misinformation" problem: by signaling its (unjustified) confidence in the securities being sold, the seller inadvertently misleads investors into buying those securities.[169] Mutual-misinformation problems are intractable almost by definition. Nonetheless, to the extent these problems are caused by the inherent uncertainty of securities being priced off quantitative models in the absence of an actual or active market,[170] the depth of the resulting losses in the subprime crisis suggests that investors—at least in the short term—are likely to avoid such reliance, obviating the need for a regulatory response.[171] Still, because investors over time tend to choose higher rates of return over investment discipline,[172] there may come a time when regulation, or its threat, is needed to restore that discipline.

Private-sector certifications of quality can also improve impaired securities disclosure, especially where the certification achieves an economy of scale. This approach is currently employed, for example, through rating-agency ratings on debt securities.[173] In the subprime crisis, however, rating agencies were said to contribute to the crisis,[174] and there are various proposals under consideration to improve the quality of the rating system.[175] Although it is too early to know the extent to which these proposals will improve the rating system, it is doubtful that any type of government certification would be more successful. In the United States, at least, private-sector analysts tend to be more capable and more accountable than government analysts due at least in part to the former's higher compensation incentives.[176]

These are all only second-best or partial solutions to the problem of uncertainty. There do not, however, appear to be any perfect solutions. Government already takes a somewhat paternalistic stance by mandating

169. This approach also could be misleading to the extent, for example, the retained securities bear higher interest rates than those being sold, compensating for the risk. Failure to disclose that higher rate, however, is likely to constitute securities law fraud, at least in the United States.

170. *See supra* notes 84–86 and accompanying text.

171. *Cf. infra* notes 284–85 and accompanying text (observing that investors tend, over time, to forsake investment discipline for higher rates of return).

172. *See infra* note 285.

173. *See supra* note 75 and accompanying text (observing, among other things, that debt securities are rated by their likelihood of timely payment).

174. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 400–04.

175. *Cf.* Richard Barley, *Ability to Track Risk Has Shrunk 'Forever'-Moody's*, REUTERS, Jan. 6, 2008, http://www.reuters.com/articlePrint?articleId=USL0455354526680107 (explaining a statement by Moody's Investor Services that in the face of extreme complexity arising from financial innovation, the ability to track risk had been severely undermined, and that market participants should be required to hold additional capital).

176. Schwarcz, *Disclosure's Failure*, *supra* note 52, at 1120.

minimum investor sophistication for investing in complex securities; yet sophisticated investors and qualified institutional buyers (QIBs) are the very investors who lost the most money in the subprime financial crisis.[177] And any attempt by government to restrict firms from engaging in complex transactions would be risky because of the potential of inadvertently banning beneficial transactions.[178]

The discussion above addresses when uncertainty causes failure through impaired securities disclosure. Uncertainty also can cause failure when information about market participants is not made public. This is illustrated by counterparty risk among market participants on CDS and other derivatives contracts.[179] This risk is problematic because market participants are unable to discern how much contingent exposure their counterparties have to other market participants.[180]

Counterparties can mitigate this risk voluntarily by disclosing their contingent liabilities on credit derivatives. Regulation also can enhance the disclosure, such as by requiring counterparties to credit-derivative transactions, or intermediaries for those parties, to keep a registry of the transactions from which market participants can ascertain risk allocation.[181] The extent to which enhanced disclosure will prove useful is uncertain, though. Under generally accepted accounting principles (GAAP), counterparties are already required to disclose many of their contingent liabilities.[182] However, subtle judgment calls must be made as

177. *See, e.g.*, Jenny Anderson, *Wall St. Banks Confront a String of Write-Downs*, N.Y. TIMES, Feb. 19, 2008, at C1 ("[M]ajor banks . . . have already written off more than $120 billion of losses stemming from bad mortgage-related investments."); Randall Smith, *Merrill's $5 Billion Bath Bares Deeper Divide—After Big Write-Down Tied to Mortgage Debt, O'Neal Asserts Control*, WALL ST. J., Oct. 6, 2007, at A1 (reporting a total of $20 billion in write-downs by large investment banks).

178. *See supra* notes 154–55 and accompanying text; *see also* Gerard Caprio, Jr., Ash Demirguc-Kunt & Edward J. Kane, *The 2007 Meltdown in Structured Securitization: Searching for Lessons Not Scapegoats* 5 (Nov. 23, 2008), *available at* www.ssrn/abstract=1424352 ("[A] tightly regulated financial system hampers growth.").

179. *See supra* notes 130–38 and accompanying text.

180. *See supra* notes 134–36 and accompanying text.

181. *See, e.g.*, Christopher Cox, Op-Ed, *Swapping Secrecy for Transparency*, N.Y. TIMES, Oct. 19, 2008, at A12 ("Congress could require that dealers in over-the-counter credit-default swaps publicly report both their trades and the value of those trades.").

182. Contingent liabilities must be disclosed, at least in the footnotes to a firm's financial statements, if the contingency is merely a "reasonable possibility." FIN. ACCOUNTING STANDARDS BD., ACCOUNTING FOR CONTINGENCIES STATEMENT OF FINANCIAL ACCOUNTING STANDARDS NO. 5: 6 (1975) (allowing only remote risks to remain undisclosed). Sarbanes–Oxley also attempts to maximize GAAP disclosure of contingent liabilities by amending Section 13 of the Securities Exchange Act of 1934, 15 U.S.C. § 78(m) (2006), to add a new subsection (j), requiring the SEC to issue

> final rules providing that each annual and quarterly financial report required to be filed with the Commission shall disclose all material off-balance sheet transactions, arrangements,

to how likely a contingency is to occur. If a counterparty assesses the likelihood as higher than it actually is, market participants may unnecessarily avoid doing business with the counterparty. But if the counterparty assesses the likelihood as lower than it actually is, market participants may be underpricing the risk of doing business with the counterparty.[183]

Another hurdle to imposing enhanced disclosure through regulation is that derivatives are chameleon-like—they easily can change form and appearance—and there are myriad ways that risk can be transferred in transactions not regarded as derivatives, such as a simple guarantee for payment of a fee. Even a simple loan agreement can be characterized as a credit derivative.[184] Any regulation of credit derivatives, therefore, will have to grapple with the problem of defining what is being regulated, with a narrow focus potentially omitting risk transfers that should be covered and a broad focus potentially being overly restrictive by including traditional commercial transactions.

If disclosure-related approaches are inadequate to address the uncertainty and information failures caused by credit derivatives, the next step might be to consider banning or otherwise limiting credit derivatives. This Article does not address that next step.[185] Risk transfer is not inherently bad; indeed it can maximize efficiency if risk is transferred—as is the goal of credit derivatives—to parties better able to bear the risk.[186] Nonetheless, future research should explore whether, as might have

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> obligations (including contingent obligations), and other relationships of the issuer with unconsolidated entities or other persons, that may have a material current or future effect on financial condition, changes in financial condition, results of operations, liquidity, capital expenditures, capital resources, or significant components of revenues or expenses.

Sarbanes–Oxley Act of 2002, Pub. L. No. 107-204, § 401(j), 116 Stat. 786 (2002).

183. Another possible approach to mitigate counterparty risk might be for CDS contracts, which have many characteristics of insurance, SCHWARCZ, STRUCTURED FINANCE, *supra* note 47, § 10:4.1, to be regulated like insurance policies. This approach is beyond this Article's scope.

184. *Cf.* 11 U.S.C. § 101(53B) (broadly defining a "swap agreement"). I personally have seen loan transactions structured as swaps, and Professor Hu reports of a case where a bank mistakenly thought a loan was a swap. Hu, *supra* note 3, at 1480; *see also In re* Nat'l Gas Distributors, LLC, 556 F.3d 247 (4th Cir. 2009) (observing that 11 U.S.C. § 101(53B)'s broad definition "barely distinguish[es] any major commercial contract from a swap agreement"). *Cf.* ANDREW M. CHISHOLM, DERIVATIVES DEMYSTIFIED: A STEP-BY-STEP GUIDE TO FORWARDS, FUTURES, SWAPS AND OPTIONS 1 (2004) (defining a "derivative" as an asset whose value is derived from the value of some other asset known as the underlying); 12 C.F.R. § 563.172 (2009) (defining a "financial derivative" as a "financial contract whose value depends on the value of one or more underlying assets, indices, or reference rates").

185. *But cf. supra* notes 154–64 and accompanying text (arguing that proscribing transactions with impaired disclosure would inadvertently ban many beneficial transactions).

186. REPORT OF THE PRESIDENT'S WORKING GROUP ON FINANCIAL MARKETS, HEDGE FUNDS, LEVERAGE, AND THE LESSONS OF LONG TERM CAPITAL MANAGEMENT (1999).

occurred in the subprime crisis, credit derivatives have dispersed risk so broadly as to create a type of collective-action problem: the ultimate risk-bearing parties do not always have sufficient amounts at risk regarding any given underlying credit risk to motivate them to engage in due diligence.[187]

Lastly, it should be recalled that the indirect-holding system for securities increases uncertainty about market participants.[188] The proper response in this context is complicated by the fact that the indirect-holding system evolved to reduce the costs of record keeping and to lower the risk of loss occasioned by physically transferring securities.[189] Any approach to deviate from that system in order to reduce uncertainty would thus have to take into account the possibility of increasing record keeping costs and losses—an analysis beyond the scope of this Article. In another context, however, this Article proposes that a firm should be able, at least during crises of investor confidence and turbulent markets, to avoid having to mark its securities portfolio to market by fully disclosing its underlying asset portfolio.[190] This same approach could be used to reduce uncertainty without needing to modify the indirect-holding system.

B. Addressing Failures Arising from Nonlinear Feedback and Tight Coupling

Recall that when financial markets exhibit properties of a complex system, the ability to predict consequences, such as cause-and-effect explanations for market movements, is frustrated by nonlinear feedback effects arising from interactivities.[191] Nonlinear feedback is especially dangerous when combined with tight coupling.[192]

Currently, the most significant such combination is marking-to-market.[193] Although marking-to-market generally stabilizes financial markets by creating trust that assets are fairly valued, it destabilizes

187. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 390–91. Any regulation limiting credit derivatives would similarly have to grapple with the problem of defining what is being regulated; *see supra* note 184 and accompanying text.

188. *See supra* note 110 and accompanying text (observing that third parties cannot readily determine who owns, and thus has credit exposure to, specific securities because there is no single location from which they can easily get that information).

189. *See supra* note 109 and accompanying text.

190. *See infra* notes 200–04 and accompanying text.

191. *See supra* notes 122–28 and accompanying text. It is less useful to try to determine which is the cause and which is the effect than to try to understand the interactive patterns and potential feedback effects.

192. *See supra* text accompanying note 115.

193. *See supra* notes 115–22 and accompanying text.

markets when investors lose confidence during times of market turbulence; then, requiring firms to sell assets to meet margin calls can artificially depress asset prices, causing a downward spiral.[194]

This type of interactive complexity has led some to argue that quantitative tools should be augmented to perceive and account for the "observable and systematic" behavioral patterns that emerge as usually diverse market segments begin moving in lockstep, or where investors exhibit herding behavior.[195] In the case of marking-to-market, one way to account for the interactive pattern is to recognize, as the subprime crisis has revealed, that liquidity and default are not always correlated.[196] In that crisis, holders of securities that were unaffected by defaults found it difficult to sell or refinance those securities.[197] This difficulty, in turn, created an even greater crisis of confidence, causing the market to collapse.[198] At least part of the problem was caused by the requirement that firms sell the securities as market prices drop, causing prices to drop further.[199]

This downward spiral could have been mitigated, if not prevented, by recognizing that when investors lose confidence and markets become turbulent,[200] marking-to-market can be misleading and potentially dangerous.[201] Although the feedback effect of marking-to-market dampens price perturbations in normal times, thereby stabilizing the financial system, the feedback effect of marking-to-market amplifies perturbations when investors lose confidence, thereby destabilizing the financial system.[202] Regulators then should allow firms to substitute other measures of investor comfort for marking-to-market. One possible approach, for example,[203] is to allow a firm otherwise required to mark-to-market to

194. *See id.*

195. Alan Greenspan, *We Will Never Have a Perfect Model of Risk*, FIN. TIMES, Mar. 17, 2008, at 9.

196. *See, e.g.*, Dr. Alexander Dibelius, Chairman, Goldman Sachs Deutschland, Address at the Int'l Berlin Business and Trade Law Conference, Humboldt University (June 12, 2008) (notes on file with author) (observing that liquidity and default are not necessarily correlated).

197. *See, e.g.*, Bank of N.Y. v. Mont. Bd. of Invs., [2008] EWHC (Ch) 1594 (Eng.) (observing, at paragraph twenty-one of the opinion, that extreme illiquidity in the structured products markets reduced the market value of the (largely non-defaulted) collateral to significantly less than the present value of the collateral's expected cash flows).

198. Dibelius, *supra* note 196.

199. *See supra* notes 120–21 and accompanying text.

200. *Cf.* Paul Krugman, *A Catastrophe Foretold*, N.Y. TIMES, Oct. 26, 2007, at A25 (asserting that the downgrade of AAA bonds created a "crisis of confidence" in financial markets).

201. CRMPG III REPORT, *supra* note 54, at 132–33.

202. *Cf. id.*; Posting of Yves Smith & Richard Kline to Naked Capitalism Blog, http://www.nakedcapitalism.com (May 12, 2008, 07:00 EST).

203. Another possible approach, suggested by Professor Ron Blasi, is to base mark-to-market

have the option, instead, to disseminate full disclosure of its underlying asset portfolio.[204] For example, a firm that owns CDO securities could choose to disclose details about the mortgage loans and other financial assets underlying those securities in lieu of marking the securities to market,[205] thereby enabling investors and other market participants to make more transparent valuations. This approach also would help reduce the anomaly,[206] seen during the subprime crisis, of securities bearing market values substantially below their intrinsic values—the latter representing the present value of the reasonably expected cash flows of those securities.[207]

As financial markets evolve, other nonlinear feedback effects will undoubtedly become tightly coupled in ways one cannot predict ex ante. It is also impossible to know precisely how future financial crises will arise. Consideration, therefore, should be given to more broad spectrum regulatory solutions.[208]

One such possible approach is to establish a governmental entity to act, if needed, as a market liquidity provider of last resort (hereinafter, "market liquidity provider") in order to more loosely couple the feedback effects.[209]

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accounting on a trailing average rather than a one-day snapshot of market values. Memorandum from Ronald W. Blasi, Professor of Law, Georgia State University, to the author (Nov. 17, 2008) (on file with author). This approach would at least dampen the amplifying perturbations.

204. This "full disclosure" option has been proposed by Dr. Alexander Dibelius, *supra* note 196, and also by Donald S. Bernstein, Partner & Head, Insolvency & Restructuring Practice Group, Davis Polk & Wardwell, in remarks at the International Insolvency Institute's Eighth Annual International Insolvency Conference (June 10, 2008) (notes on file with author).

205. *See supra* note 44 and accompanying text (describing the assets that underlie CDO securities).

206. For an interesting conjecture on whether this indeed is anomalous, see Hellwig, *supra* note 3, at 41 (arguing that although the notion that the market value of securities may be significantly below the expected present value of their future cash flows "seems incompatible with the theory of asset pricing in informationally efficient markets," it can be explained by limitations on investor funds or investor worries about refinancing).

207. *See* Schwarcz, *Keynote Address*, *supra* note 3; *Containing Systemic Risks and Restoring Financial Soundness*, GLOBAL FIN. STABILITY REP. (Int'l Monetary Fund, Washington, D.C.) (Apr. 2008) (suggesting that the market prices of at least some mortgage-backed securities may be significantly below the expected present values of their future cash flows). This amount could be measured by examining the mortgage loans underlying the securities and ascertaining which were subprime, which were prime, and which were delinquent or in default, and then estimating the expected present values of those cash flows). *See* Simon Gervais & Steven L. Schwarcz, Valuation of Risky Cash Flows (working paper, on file with author).

208. *Cf.* CRMPG III REPORT, *supra* note 54, at 102 (proposing that a resilient market for credit derivatives requires that shocks be "absorb[ed], rather than amplify[ied]").

209. *See infra* notes 211–29 and accompanying text (discussing how a liquidity provider of last resort could more loosely couple financial-market feedback effects). For a discussion of logistical and cost-benefit issues associated with a liquidity provider of last resort, *see infra* notes 229–52 and accompanying text.

This approach takes inspiration from chaos theory,[210] which recognizes that failures are almost inevitable in complex systems, and that successful systems are those in which the consequences of a failure are limited.[211] This approach is also consistent with engineering design, in which decoupling systems through modularity helps to reduce the chance that a failure in one part of a complex system will systemically trigger a failure in another part.[212] "Modularity allows complexity to become manageable by . . . *partially closing off* some parts of the system and allowing these encapsulated components to interconnect only in certain ways."[213] Thus, when a component of a system fails, modularity enables repairs to be made before the entire system shuts down.[214]

A market liquidity provider would work in much this same way, providing functional "modularity" to limit the consequences of financial-market failure by directly investing in securities of panicked markets. Financial markets rely critically on the supply of liquidity in the form of credit.[215] If a failure deprives a particular market of liquidity, a market liquidity provider can restore liquidity before that market collapses and endangers other financial markets.[216]

For example, a market liquidity provider could provide market liquidity[217] by investing in securities of artificially falling financial

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210. *See supra* note 142 and accompanying text (introducing chaos theory).

211. J.B. Ruhl & Harold J. Ruhl, Jr., *The Arrow of the Law in Modern Administrative States: Using Complexity Theory to Reveal the Diminishing Returns and Increasing Risks the Burgeoning of Law Poses to Society*, 30 U.C. DAVIS L. REV. 405, 467–68 (1997); *see also* PER BAK, HOW NATURE WORKS: THE SCIENCE OF SELF-ORGANIZED CRITICALITY (1996).

212. Charles B. Perrow, *Complexity, Catastrophe, and Modularity*, 78 SOC. INQUIRY 162 (2008).

213. Henry E. Smith, *Modularity in Contracts: Boilerplate and Information Flow*, 104 MICH. L. REV. 1175, 1180 (2006).

214. *Id.*; *see also* Zuoyi Zhang & Yuliang Sun, *Economic Potential of Modular Reactor Nuclear Power Plants Based on the Chinese HTR-PM Project*, NUCLEAR ENGINEERING & DESIGN 2265 (2007) (explaining that, after the Three-Mile Island reactor meltdown, nuclear power plants began to use modularity to increase safety measures against similar, nonlinear catastrophes).

215. *See supra* note 106 and accompanying text.

216. *Cf.* Michael D. Bordo, Bruce Misrach, & Anna Schwartz, *Real Versus Pseudo-International Systemic Risk: Some Lessons From History* 19 (Nat'l Bureau of Econ. Research, Working Paper No. 5371, 1995) (observing that financial panic will not usually become contagious when a lender of last resort provides adequate liquidity). In the Great Depression, for example, economists believe that the negative effects would have been considerably muted through actions by the government central bank to provide the needed liquidity to maintain stability within the monetary supply. *Id.* at 21.

217. For clarity, this discussion differentiates "market illiquidity," in which illiquidity in a market causes specific assets in that market to be undervalued, from "funding illiquidity," in which illiquidity in a market for short-term investments threatens to undermine long-term investments that are funded by the short-term investments. *Cf. infra* notes 220–22 and accompanying text (discussing funding liquidity). Both market illiquidity and funding illiquidity are forms of illiquidity in markets. I thank Laura Ellen Kodres, Chief, Global Financial Stability Division, International Monetary Fund, for pointing out this distinction.

markets—markets in which the price of securities falls measurably below the intrinsic value of the assets underlying the securities (which might result from a panic, as occurred in the subprime crisis when mortgage-backed securities prices fell below the present value of the expected cash flows on the underlying mortgages[218]). Such liquidity would help to stabilize asset prices and dampen the over-amplification of marking-to-market that can lead to market collapse.[219]

A market liquidity provider also could address temporary problems of funding illiquidity. This occurs when illiquidity in a market for short-term investments threatens to undermine long-term investments that are funded by the short-term investments. For example, an investment vehicle, such as an asset-backed commercial paper (ABCP) securitization conduit,[220] may fund the purchase of long-term financial assets, such as bonds, by issuing short-term commercial paper, expecting to refinance by issuing new commercial paper (i.e., "rolling over" the commercial paper). If the market for commercial paper is temporarily disrupted, as occurred during the subprime crisis, and the securitization conduit cannot obtain immediate alternative financing, it will default.[221] In instances where market participants reasonably use short-term funding to invest in long-term assets and the market illiquidity is unexpected and temporary,[222] a market

218. *See supra* note 207 and accompanying text. The mechanics of timing purchases will be critical. Because markets normally can fluctuate widely, a market liquidity provider should contemplate acting only when fluctuations are outside of normal ranges.

219. *See supra* notes 115–21 and 200–02 and accompanying text (discussing how marking-to-market in turbulent financial markets can lead to market collapse). In the subprime crisis, for example, a market liquidity provider could have stepped in to purchase sufficient quantities of mortgage-backed securities to stabilize the MBS markets. Say the intrinsic value of a type of mortgage-backed securities, calculated by taking the present value of the expected value of the cash flows on the mortgage loans backing those securities, is eighty cents on the dollar. If the market price of those securities had fallen to, say, twenty cents on the dollar, the market liquidity provider could purchase these securities at, say, sixty cents on the dollar cash. But it could also agree to pay a higher "deferred purchase price" for securities that turn out to be worth more than expected. The large discount ensures that the market liquidity provider, and thus taxpayers, should not lose money. And the deferred purchase price protects sellers from giving up, or having to write off on their books, too much value. *See* Steven L. Schwarcz, *The Case for a Market Liquidity Provider of Last Resort*, 5 N.Y.U. J. L. & BUS. 346 (2009), *available at* http:/ssrn.com/abstract_id=1346542. For an explanation of why, if prices are artificially low, private investors cannot be counted on to invest and make this profit, see *infra* notes 244–50 and accompanying text.

220. For a brief primer on ABCP securitization conduits, see Michael Durrer, *Asset Backed Commercial Paper Conduits*, 1 N.C. BANKING INST. 119, 119 (1997).

221. The President's Working Group on Financial Markets Policy Statement on Financial Market Developments, 14 LAW & BUS. REV. AM. 447, 455–56 (2008) [hereinafter Policy Statement] (suggesting that some thirty percent contraction of the ABCP market in the U.S. in 2007 was a factor contributing to the financial crisis).

222. The conditions that the use of short-term funding to invest in long-term assets be reasonable and that any market illiquidity be unexpected are intended to minimize moral hazard. *See infra* note

liquidity provider could consider providing the alternative financing.[223]

In these ways, a market liquidity provider not only would reduce the chance of any given financial market collapse by restoring liquidity but also would reduce systemic risk by decoupling the chance that a failure in one market would trigger a failure in other markets.[224]

These roles of a market liquidity provider go substantially beyond the U.S. Federal Reserve's (the "Fed") historical actions as lender of last resort to financial institutions, much less the actions of other national central banks. Under the Federal Reserve Act, the Federal Reserve Bank is authorized to, and customarily does, offer loans to banks that need credit.[225] In response to the subprime crisis, the Federal Reserve extended its lending availability to "near banks" like investment banks.[226] If needed, the Fed even has power to extend lending availability to any entity, not merely banks and near banks, whose failure might bring down the larger financial system.[227] The extent of the Fed's power, much less its

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236 and accompanying text.

223. *Cf.* Hellwig, *supra* note 3, at 39:

> Short of buying the securities themselves, the central-bank intervention [in the subprime crisis] could not eliminate the systemic problem that, with the breakdown of conduit and SIV refinancing, there was a large overhang of long-term asset-backed securities that needed refinancing at a time when the fundamental value of these assets was questionable and the associated risks were seen as a potential threat to any institution that was holding them.

Id. The ability to invest directly in market securities can also protect the integrity of secondary markets for re-sale of securities. Schwarcz, *Systemic Risk*, *supra* note 3, at 225–28.

224. *Cf. supra* notes 212–16 and accompanying text (referring to this as functional modularity).

225. *See*, *e.g.*, Christopher Anstey & Steve Matthews, *Fed's Direct Loans to Banks Climb to Record Level (Update 2)*, BLOOMBERG, May 15, 2008, http://www.bloomberg.com/apps/news?pid=20670001&sid=aur2QcWbKf2U. Section 13(3) of the Federal Reserve Act (12 U.S.C. § 343) enables the Board of Governors of the Federal Reserve System, in "unusual and exigent circumstances," to "authorize any Federal reserve bank . . . to discount for any individual, partnership, or corporation, notes, drafts, and bills of exchange" if such individual, partnership, or corporation is "unable to secure adequate credit accommodations from other banking institutions." The publicity about the original "liquidity injections" by the Federal Reserve in response to the subprime crisis did not represent direct increases in money availability but merely a lowering of the "discount rate" at which such loans are made, thereby providing a more attractive borrowing environment for banks. *See, e.g.*, Jeremy W. Peters, *The Banks Roll Up Their Sleeves*, N.Y. TIMES, Aug. 19, 2007, at 2 (observing that when the Federal Reserve makes "liquidity injections" into the banking system, "the Fed doesn't even use real money," and explaining that liquidity results from offering Fed loans to banks at the discount rate, a lower interest rate than the "fed funds rate" that banks would charge other banks on interbank loans). Moreover, that "liquidity injection" affected only banks, not non-banks or financial markets. *See* Kim Clark, *Fed 'Injections': Who Benefits?*, U.S. NEWS & WORLD REP., Aug. 15, 2007, http://www.usnew.com/usnews/biztech/articles/070815/15blinder.htm (explaining that the Fed is merely "lending to banks that need the funds and charging them interest"); Peters, *supra*, at 2 (discussing the Federal Reserve's ability to "inject" liquidity by lending money to banks so that they do not have to borrow elsewhere at higher interest rates).

226. *Systemic Risk and the Financial Markets: Hearing Before the H. Comm. on Fin. Servs.*, 110th Cong. 2 (2008) (statement of Ben Bernake, Federal Reserve Chairman).

227. *See supra* note 225 (referencing Section 13(3) of the Federal Reserve Act, which enables the

willingness, to provide liquidity to markets directly has been less clear, however.

Adaptation in that direction is critical, though, because of the ongoing shift (known as "disintermediation") of the source of corporate financing from banks to financial and capital markets.[228] This Article's conception of a market liquidity provider would take on this new role of protecting these markets directly. Had such a market liquidity provider been in existence when the subprime crisis started, the resulting collapse of the credit markets may well have been restricted in scope and lessened in impact.[229]

The above discussion raises the question of whether these potential benefits of using a market liquidity provider would exceed its costs. As shown below, a market liquidity provider should generate relatively minimal costs, and certainly lower costs than those of a lender of last resort to institutions.[230] In related contexts, I have shown the relevant costs to be taxpayer expense and moral hazard.[231] By providing a lifeline to financial institutions, a lender of last resort fosters moral hazard by potentially encouraging these institutions—especially those that believe

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Board of Governors of the Federal Reserve System, in "unusual and exigent circumstances," to "authorize any Federal reserve bank . . . to discount *for any individual, partnership, or corporation*, notes, drafts, and bills of exchange") (emphasis added). 12 U.S.C. § 343 (2008).

228. Schwarcz, *Systemic Risk*, *supra* note 3, at 200. *Cf.* Mortimer B. Zuckerman, *No Time to Lose*, U.S. NEWS & WORLD REP., Mar. 2009, at 80 (observing that securitization "once accounted for seventy percent of our credit while conventional bank lending had dropped to thirty percent. Unless financial firms can securitize debt and, in turn, rely on investors willing to buy [securities representing] the bundled loans, credit will remain extremely tight.").

229. Schwarcz, *Systemic Risk*, *supra* note 3, at 229, 248–49; *see also supra* notes 218–19 and accompanying text. I do not propose that existing safety nets be discarded. This Article's conception of a market liquidity provider of last resort would supplement, not replace, a lender of last resort. The combination, however, would be synergistic: by stabilizing financial markets, a market liquidity provider not only would preserve credit but also would minimize the likelihood that institutions invested in those markets will ultimately fail—thereby reducing the times when a lender of last resort would be needed.

230. Another way to help transform our tightly coupled financial system into one that is more weakly coupled would be to require near banks, *see supra* note 226 and accompanying text (defining "near banks"), to maintain minimum capital requirements, like banks. Capital requirements, however, are very expensive. *See, e.g.*, Raj Bhala, *Applying Equilibrium Theory and the Ficas Model: A Case Study of Capital Adequacy and Currency Trading*, 41 ST. LOUIS U. L.J. 125, 132 (1996) ("[T]he greater the capital requirements, the more expensive it is to trade in the markets . . . ."); Michael E. Bleier, *Operational Risk in Basel II*, 8 N.C. BANKING INST. 101, 103–04 (2004) ("The new capital requirement for operational risk can be fairly expensive for specialized financial institutions with significant concentration in asset management, custody, and other businesses that would, for the first time carry a capital requirement.").

231. *See* Schwarcz, *Systemic Risk*, *supra* note 3, at 225–30; Steven L. Schwarcz, *Sovereign Debt Restructuring: A Bankruptcy Reorganization Approach*, 85 CORNELL L. REV. 956, 961–66 (2000).

they are "too big to fail"—to be fiscally reckless.[232] Moreover, loans made to these institutions will not be repaid if the institutions eventually fail.

In contrast, a market liquidity provider, especially if it acts at the outset of a market panic, can profitably invest in securities at a deep discount from the original market price and still provide a "floor" to how low the market will drop.[233] Indeed, this Article proposes that a market liquidity provider should consider providing market liquidity *only* when it believes it can profit (or at least break even) because its mission should be to correct market failures, such as might be caused by a panic or other investor overreaction.[234] Moral hazard should also be minimized: speculative investors will be hurt by the market liquidity provider's deeply discounted purchases,[235] and investing in markets, not institutions directly, should reduce rent-seeking behavior by institutions that believe they are too big to be allowed to fail.[236] Additionally, by stabilizing financial markets, a market liquidity provider will minimize the likelihood that institutions investing or insuring risk in those markets will ultimately fail, further reducing the times when a lender of last resort would be needed. If financial markets had not broken down, for example, institutions like Bear Stearns, AIG, and Citigroup would not have needed to be bailed out.[237] In

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232. *See, e.g.*, GARY H. STERN & RON J. FELDMAN, TOO BIG TO FAIL: THE HAZARDS OF BANK BAILOUTS (2004); Robert L. Hetzel, *Too Big to Fail: Origins, Consequences, and Outlook*, FED. RES. BANK OF RICHMOND ECON. REV., Nov.–Dec. 1991, at 3. Although ideally a lender of last resort should adopt a policy of "constructive ambiguity" in its lending decisions and further restrict its lending to entities that are merely experiencing temporary liquidity crises but that otherwise are financially healthy, Schwarcz, *Systemic Risk*, *supra* note 3, at 226–27, these restrictions may not be politically viable if the entity's failure would negatively impact the real economy. *See Finance and Economics: Not Yet the Last Resort*, ECONOMIST, Oct. 11, 2008, at 108 (asserting that "the political risks of doing too little and letting the economy slide" may outweigh restrictions on loans by the Fed).

233. *See supra* notes 218–23 and accompanying text (explaining why, in the subprime crisis, a market liquidity provider could have profitably purchased mortgage-backed securities at a deep discount and still have stabilized the market significantly above the present disastrous levels).

234. *See supra* notes 216–19 and *infra* notes 245–46 and accompanying text.

235. Investor moral hazard can be further limited if the market liquidity provider adopts a policy of constructive ambiguity, not stating ex ante whether or not it will attempt to stabilize any given market panic and not indicating in advance the purchase price it would offer if it were to attempt to do so. Schwarcz, *Systemic Risk*, *supra* note 3, at 226–27. Investor moral hazard cannot be eliminated, however, because certain markets may be so important that investors can predict their stabilization with a high degree of certainty.

236. In contrast, a market liquidity provider used to finance temporary problems of funding illiquidity, *see supra* notes 219–23 and accompanying text, could increase moral hazard to the extent market participants use less care in addressing funding gaps. This Article's proposal—that a market liquidity provider consider providing such financing only when market participants have reasonably used short-term funding to invest in long-term assets and the subsequent market illiquidity is unexpected—is intended to minimize that moral hazard. *See supra* note 222.

237. Schwarcz, *Keynote Address*, *supra* note 3, at 553 (explaining that the collapse in financial-market prices meant that banks and other financial institutions holding securities in those markets had

economic terms, therefore, any safety net subsidies created by a market liquidity provider will be much smaller than those created by a lender of last resort.[238]

Perhaps for these reasons, the United States Department of the Treasury, responding to the possible collapse of Fannie Mae and Freddie Mac, announced in September 2008 that it would purchase securities issued by Fannie and Freddie to the extent investors do not do so, thereby stabilizing the mortgage-backed securities markets and reducing mortgage rates.[239] This was the first time that any government entity agreed to act in a market-liquidity-provider capacity.[240]

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to write down their value, causing these institutions to appear more financially risky, in turn triggering lack of confidence and concern over counterparty risk).

238. *Cf.* Caprio, Demirguc-Kunt & Kane, *supra* note 178, at 9 (arguing that the goal of financial regulation and supervision is "to manage the [regulatory] safety net so that private risk-taking is neither taxed nor subsidized"); *id.* at 6 (arguing that, ideally, regulated parties should not have opportunities to "shift the deep downside of their risk exposures onto the [regulatory] safety net").

239. Henry M. Paulson, Secretary of the Treasury, United States Department of the Treasury, Treasury and Federal Housing Finance Agency Action to Protect Financial Markets and Taxpayers, Statement to the Press (Sept. 7, 2008). Although this was one of four steps announced by Secretary Paulson to address the problems of Fannie Mae and Freddie Mac, the other steps—placing these entities into conservatorship, committing to purchase senior-priority preferred stock in these entities to maintain a positive net worth, and establishing a secured lending credit facility for these entities—would have no application to stabilizing financial markets generally.

240. More recently, the United States has tried to restore market confidence by "provid[ing] direct financing to businesses by buying three-month commercial paper . . . [and] provid[ing] loans to banks and other financial institutions that buy asset-backed commercial paper from money-market mutual funds." Michael M. Grynbaum, *Moves to Shore Up More Funds, Ensuring Safety of Money Markets*, N.Y. TIMES, Oct. 22, 2008, at B9. Similarly, the U.S. government's Term Asset-Backed Securities Loan Facility, or TALF, contemplates investing government funds in certain consumer-asset-backed securities to reduce consumer financing costs, although its results are not yet known. The original Troubled Assets Relief Program, or "TARP," under the Emergency Economic Stabilization Act of 2008 had contemplated government purchases of mortgage-backed securities, at least partly for the purpose of stabilizing market prices, at a price above the collapsed "market" price but discounted from what the securities are intrinsically worth. The TARP plan, however, ran into immediate political hurdles based on misunderstanding the distinction between market price and intrinsic value. Because the purchase price paid by the government would have to be above "market" to avoid even further counterparty write-offs, there was a populist perception that the government would be unjustifiably bailing out Wall Street. *See, e.g.*, Mortimer B. Zuckerman, *We Deserve a Better Bailout*, U.S. NEWS & WORLD REP., Oct. 20, 2008, at 79 (arguing that buying the MBS at above-market prices "provide[s] a huge, unjustified bailout of Wall Street" by "rescu[ing] the financial industry from the consequences of its own misjudgments, profligacy, and greed"). Partly for these reasons, and partly because economists misjudged (in my opinion) the accounting and legal feasibility of purchasing securities directly, TARP money was ultimately used mostly to purchase priority equity interests in troubled financial institutions. Those purchases did little, however, to stabilize financial markets. *Cf.* Alan S. Blinder, *Missing the Target With $700 Billion*, N.Y. TIMES, Dec. 21, 2008, at BU 4 (arguing that the TARP's rationales for buying MBS included establishing objective valuations and restarting the markets for these securities, thereby revitalizing mortgage finance, and that using TARP funds to buy equity in banks rather than MBS "wasted a precious resource," likening such misuse to "another disaster" like the Iraq war and the response to Hurricane Katrina).

One might ask whether failed efforts of governments to try to control their currency exchange rates indicate that a market liquidity provider, even if governmental, would have insufficient spending power to stabilize irrationally panicked debt markets. Only Hong Kong was able to control its currency exchange rate, and that was because its reserves—which implicitly included all of China's reserves—were large enough to be credible.[241] There are important distinctions, though, between controlling a currency exchange rate and stabilizing an irrationally panicked debt market. Controlling a currency exchange rate depends on all of the macroeconomic factors to which the country in question is subject, whereas stabilizing a panicked debt market depends mostly on factors specific to the debt securities in question. Also, because the market liquidity provider should consider acting only when a panicked debt market is so irrational that the market value of its securities falls measurably below their intrinsic value,[242] the market liquidity provider should be able to stem the information asymmetry leading to this valuation differential by explaining the irrationality and, by buying at an above-market price, putting its money where its mouth is.[243] It effectively would be providing to investors in that debt market the same type of real credibility and comfort that a country's large reserves provide to currency investors.[244]

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241. Mark L. Clifford, *Hong Kong's Currency Cop; Joseph Yam's Duty: Defend the Dollar Against All Comers*, BUS. WK., Sept. 23, 1996, at 60 (discussing Hong Kong's currency controls and China's tacit approval thereof).

242. *See supra* notes 217–18 and accompanying text. The market liquidity provider also could act to prevent funding illiquidity, but the amounts needed for that purpose should be relatively small.

243. The ability of a market liquidity provider to stabilize market prices might have particular problems in a thin market that does not react responsively to its purchases. In the subprime crisis, for example, at least a portion of the MBS markets, including those for ABS CDO securities, were privately-placed debt markets. Nonetheless, there was a virtual market for ABS CDO securities, created by the ABX.HE indices. This virtual market was sufficiently large that it should have reacted responsively to purchases made by a market liquidity provider. (The ABX.HE indices simulate the risk and reward of trading in asset- and mortgage-backed securities. A potential investor, for example, can decide to invest in asset-backed securities represented by one of the indices, without actually purchasing the underlying securities. The investor is thus not limited to specific securities, or to amounts of those securities that are actually physically available for purchase. The ABX.HE indices also help to facilitate hedging. A lender, dealer, or hedge fund with excessive asset-backed securities exposure, for example, not only can attempt to buy protection from counterparties but now can also hedge its exposure through the indices.) Stephen J. Lubben, *Credit Derivatives and the Future of Chapter 11*, 81 AM. BANKR. L.J. 405, 415 (2007) ("[S]waps written on indexes give the protection buyer a hedge against a pool of representative debtors with similar credit profiles."); *see also* Aaron Unterman, *Innovative Destruction—Structured Finance and Credit Market Reform in the Bubble Era*, 5 HASTINGS BUS. L.J. 53, 70 (2009) (describing the ABX index).

244. Any analogy of a market liquidity provider to The Bank of Japan's failed attempt to support the Tokyo Stock Exchange's Nikkei index would also be inappropriate. The Nikkei is an index of shares of 225 companies selected to be representative of the Tokyo Stock Exchange as a whole and

One also might ask why, if a market liquidity provider can invest in securities at a deep discount to stabilize markets and still make money, private investors will not also do so. Part of the answer is that individuals at investing firms may not want to jeopardize their reputations (and jobs) by causing their firms to invest at a time when other investors have abandoned the market.[245] Empirical evidence confirms that individuals engage in this type of "herd behavior."[246] Private investors are also risk averse,[247] and the fact that disclosure has become so complex that investors are uncertain how much securities are worth increases the perception, if not reality, of risk. Private investors also would have greater real risk if—as almost certainly would be the case—the size of their investment is insufficient to ensure market stabilization. They then face the risk that a continuing fall in market prices could systemically impact the real economy (such as by shutting down credit markets, as occurred in the subprime crisis), thereby jeopardizing even the intrinsic value of their purchased securities.[248] Furthermore, even if they are confident that the intrinsic value of the purchased securities exceeds the amount of their investment,[249] they may not want to risk having to wait until maturity of the securities to profit.[250] A market liquidity provider with the ability to

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thus the price of those shares turns on a multitude of macroeconomic factors, including Japan's financial condition.

245. *See, e.g.*, Tyler Cowen, *It's Hard to Thaw a Frozen Market*, N.Y. TIMES, Mar. 23, 2008, at BU 5 (asking why, in the context of the subprime crisis, "asset prices don't simply fall enough so that someone buys them and trading picks up again"; and answering, "why seek 'fire sale' prices when you might lose your job for doing so?").

246. *Cf.* Paul M. Healy & Krishna Palepu, *Governance and Intermediation Problems in Capital Markets: Evidence from the Fall of Enron* 26 (NAT'L BUREAU OF ECON. RESEARCH, Working Paper No. 02-27, 2002) (observing that fund manager who estimates a stock is overvalued but does not act on this analysis "and simply follows the crowd . . . will not be rewarded for foreseeing the problems . . . but neither will he be blamed for a poor investment decision when the stock ultimately crashes, since his peers made the same mistake"); Stephen M. Bainbridge, *Mandatory Disclosure: A Behavioral Analysis*, 68 U. CIN. L. REV. 1023, 1038 (2000) (discussing how herd behavior may have a reputational payoff even if the chosen course of action fails, and arguing that where "the action was consistent with approved conventional wisdom, the hit to the manager's reputation from an adverse outcome is reduced").

247. JONATHAN BERK & PETER DEMARZO, CORPORATE FINANCE 68–69 (2007).

248. Recall that intrinsic value of mortgage-backed securities is measured by first examining which mortgage loans underlying those securities are subprime, which are prime, and which are delinquent or in default. *See supra* note 207. If an obligor on a previously prime mortgage loan loses her job because the real economy is impacted, that loan may become delinquent or defaulted and, in any event, should likely be recategorized as subprime, thereby reducing its intrinsic value.

249. *See supra* note 207 and accompanying text.

250. This risk is exacerbated if the market value of undervalued securities is still falling, because investors then would not even break even on near-term resale of the securities. *Cf.* Kravitt, *supra* note 15, at 16 ("Who wants to buy securities that will have to be marked down tomorrow, even if one expects them to be worth more eventually?").

invest sufficiently large amounts to stabilize markets and also, if necessary, to wait until maturity is needed to correct these market failures.

It should be noted, however, that a market liquidity provider need not necessarily have to invest government funds, at least at the outset, to correct these market failures. Rather than purchasing securities directly, a market liquidity provider could take a more targeted approach to stabilizing panicked markets by entering into derivatives contracts to strip out risks that the market has the greatest difficulty hedging—in effect, the market's irrationality element—thereby stimulating private investment. The Obama Administration in the United States has been considering this type of public-private-partnership approach in its revised financial bailout plan.[251] By not actually purchasing securities directly, a market liquidity provider would appear to be taking less investment risk and, thus, its function may be seen as more politically acceptable.[252]

C. Addressing Failures Arising from Misalignment

Complexity causes several types of misalignment that can give rise to financial-market failures.[253] Consider first misalignment caused by the originate-to-distribute model, which can lead to moral hazard (in turn, said to cause lax lending standards) and collective-action problems.[254] Because this model is critical to the funding liquidity of banks[255] and

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251. *Cf.* Floyd Norris, *U.S. Bank Bailout to Rely in Part on Private Money*, N.Y. TIMES, Feb. 9, 2009, at A1 (reporting that the revised bailout plan would likely depend in part on private investors, such as hedge funds, private-equity funds, and perhaps insurance companies, buying distressed MBS, with the U.S. Government guaranteeing a floor value to the securities purchased).

252. *Cf. id.* (observing that having the government purchase the distressed MBS securities directly would be a "politically perilous course"). The concept of a market liquidity provider of last resort could raise other issues, such as whether its purchases could have inflationary effects or expose taxpayers to too much risk. If, for example, a market liquidity provider obtains funds to purchase securities directly or indirectly from the Federal Reserve (or a foreign central bank), the government in effect might be printing money to make the purchases—which could be viewed as a form of "quantitative easing," which could spark inflation. There also may be concern whether the very existence of a market liquidity provider could, inadvertently, make falling markets even less stable (as where parties anticipating market-liquidity-provider stabilization of a falling market wait to invest in market securities, even if they believe the securities are undervalued, until they see the price offered by the market liquidity provider). I address these and other concerns in my forthcoming paper, *Too Big To Fail?: Recasting the Financial Safety Net* (forthcoming in THE PANIC OF 2008), http://ssrn.com/abstract=1352563.

253. *Cf. supra* note 147 (noting that this Article does not cover all types of conflicts that could cause market failure, just those that result from complexity).

254. *See supra* notes 29–35 and accompanying text.

255. *See, e.g.*, Joseph R. Mason, Powerpoint presentation to the Federal Reserve Bank of Cleveland at its workshop on Structured Finance and Loan Modification, Mortgage Loan Modification: Promises and Pitfalls (Nov. 20, 2007) (showing that fifty-eight percent of mortgage liquidity in the United States, and seventy-five percent of mortgage liquidity in California, has come

corporations,[256] this Article assumes the model will continue notwithstanding its complexity. The Article explores possible solutions on that basis.[257]

The moral hazard problem arises because the originate-to-distribute model misaligns the interests of the lenders with the interests of the ultimate owners of the loans.[258] In theory, separation of origination and ownership should not matter because ultimate owners should assess and value risk before buying their ownership positions.[259] Even though lenders are better situated to make this evaluation than the ultimate owners, the latter should take steps to reduce, or to compensate for, this information asymmetry.[260] The subprime crisis demonstrates, however, that practice can diverge from theory in this context because of the complexity of disclosure, the tendency of investors to engage in herd behavior, and the possible excessive diversification of risk that undermines any given investor's incentive to monitor and see the big picture.[261]

As one solution to the moral hazard problem caused by this misalignment, regulators could require loan originators to retain some realistic risk of loss.[262] This solution, though, would still face the mutual-misinformation problem.[263] The solution also would not necessarily apply to mortgage- and other loan-brokers, who sometimes work with banks and finance companies to help make loans to borrowers.[264] Because these

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from structured finance, which relies on the originate-to-distribute model).

256. *See* Xudong An, Yongheng Deng & Stuart A. Gabriel, *Value Creation Through Securitization: Evidence from the CMBS Market* 3 (SSRN Working Paper No. 1095645, 2008) (concluding that despite the recent mortgage crisis, securitizing financial assets through the originate-to-distribute model has created value in the financial markets).

257. *Cf.* Lucian Arye Bebchuk, *A New Approach to Corporate Reorganizations*, 101 HARV. L. REV. 775, 776–77 (1988) (grafting a normative analysis onto a positive assumption, in that case taking the existence of corporate reorganizations in bankruptcy law as a given to put forth a suggestion to improve the reorganization process).

258. *See supra* notes 33–35 and accompanying text.

259. *Cf.* Policy Statement, *supra* note 221, at 451–52, 455 (recommending that investors normally make informed decisions about risk, but noting that in the subprime crisis investors over-relied on ratings instead of engaging in their own independent credit analysis because the securities were so complex).

260. *Id.* at 451–52.

261. *See supra* note 38 and accompanying text. *Cf.* Schwarcz, *Protecting Financial Markets*, *supra* note 1 (examining why investors purchasing mortgage-backed securities failed to properly analyze disclosures or to police behavior of lenders and issuers).

262. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 388. *Cf.* INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT, CONTAINING SYSTEMIC RISK AND RESTORING FINANCIAL SOUNDNESS 81 (Apr. 2008), http://www.imf.org/external/pubs/ft/gfsr/2008/01/index.htm (stating that the originate-to-distribute model creates moral hazard by relieving the originator of any risk of loss once the loan is sold).

263. *See supra* notes 168–70 and accompanying text.

264. A mortgage broker markets mortgage loans and brings lenders and borrowers together.

"brokers" earn a fee by arranging the loans without putting any of their own funds at risk, they have little incentive to rigorously police credit standards.[265] To the extent mortgage-broker participation causes lending standards to fall, however, that would be a somewhat straightforward "agency-cost" problem for lenders to solve.

Misalignment caused by the originate-to-distribute model also can create a collective-action problem when the ultimate owners of the loans are widely dispersed. This problem manifests itself most clearly in loan servicing.[266] Theoretically, this problem should be able to be alleviated by hiring competent "servicers" to service the loans on behalf of the owners, and indeed typical transactional documentation[267] provides for hiring a servicer to act on behalf of the investors who beneficially own the loans.[268]

In the subprime crisis, however, hiring servicers did not always solve the collective-action problem. Although servicers usually retained power, acting "in the best interests" of the investors in the mortgage-backed securities, to restructure the underlying mortgage loans,[269] in practice servicers were reluctant to engage in restructuring. There was uncertainty whether the servicer's costs of engaging in a restructuring would be reimbursed, whereas all foreclosure costs are reimbursed.[270] More significantly, servicers often preferred foreclosure over restructuring because the former is more ministerial and, thus, has lower litigation risk.[271] The litigation risk was exacerbated in the subprime crisis by the fact that, in many cases, cash flows deriving from principal and interest on the mortgages were separately allocated to different investor classes, or "tranches," of the securities.[272] A restructuring that, for example, reduced

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BLACK'S LAW DICTIONARY 206 (8th ed. 2004). *Compare* Wyatt v. Union Mortgage Co., 598 P.2d 45, 50 (Cal. 1979) ("A mortgage loan broker is customarily retained by a borrower to act as the borrower's agent in negotiating an acceptable loan.") *with* 24 C.F.R. § 3500.7(a)(4)–(b) (2008) (describing a mortgage broker as a lender's agent).

265. *Cf.* Alan S. Blinder, *The Case for a Newer Deal*, N.Y. TIMES, May 4, 2008.

266. *See supra* notes 40–41 and accompanying text.

267. This is usually in the so-called "pooling and servicing agreement."

268. It is also typical for originators of mortgage loans, or a specialized servicing company such as Countrywide Home Loans Servicing LP, to act as the servicer for a fee. JAMES A. ROSENTHAL & JUAN M. OCAMPO, SECURITIZATION OF CREDIT: INSIDE THE NEW TECHNOLOGY OF FINANCE 49–51 (1988) (explaining the general structure of a grantor trust when the originator of asset-backed securities services the pool of assets); Gretchen Morgenson, *Countrywide Is Upbeat Despite Loss*, N.Y. TIMES, Oct. 27, 2007, at C1 (reporting that Countrywide is the nation's largest loan servicer).

269. Gretchen Morgenson, *More Home Foreclosures Loom as Owners Face Mortgage Maze*, N.Y. TIMES, Aug. 6, 2007, at A1.

270. Schwarcz, *Protecting Financial Markets*, *supra* note 1, at 392–93.

271. *Id.* at 393.

272. Jon D. Van Gorp, Capital Markets Dispersion of Subprime Mortgage Risk 7–8 (unpublished manuscript, on file with author).

the interest rate would adversely affect investors in the interest-only tranche,[273] leading to what some have called "tranche warfare."[274]

Regulation may well be needed to address the servicing problem in existing transactions, where the underlying deal documentation is already in place.[275] But future deal documentation would be expected to address the problem without the need for regulation—such as by including clearer and more flexible servicing guidelines, more certain reimbursement procedures for loan restructuring (when the servicer determines that restructuring is superior to foreclosure), and contractual immunity from liability for servicers that act in good faith.

Misalignment can also cause failure in the form of fraud.[276] This Article has shown that current best-practice monitoring procedures in asset-backed securities transactions are not fail-safe because the servicer is not usually independent of the company originating the underlying financial assets.[277] An affiliated servicer can manipulate monitoring in ways that are undetectable unless investors, or their agents, micromanage all uses and sources of cash,[278] which might not be cost effective.

Misalignment that facilitates fraud can be addressed either by using a servicer independent of the company if there is any doubt of the servicer's integrity, or by allowing investors or their agents to micromanage the uses and sources of cash. Because the servicer of the financial assets effectively manages uses and sources of cash collections from those assets, the most

273. The conflicts among tranches can become even more complicated because CDO and ABS CDO securities sometimes also include prepayment-penalty tranches, and the different tranches "have different priorities relative to one another for the purpose of absorbing losses and prepayments on the underlying subprime mortgage loans." *Id.* at 8.

274. Hirsch, *supra* note 38 (describing tranche conflicts as a significant reason why servicers choose foreclosure over restructuring). The term, "tranche warfare," was originally coined in Kurt Eggert, *Held Up in Due Course: Predatory Lending, Securitization, and the Holder in Due Course Doctrine*, 35 CREIGHTON L. REV. 503, 563 (2002).

275. Regulatory changes that are subsidized in whole or part by government, however, could foster moral hazard, potentially making future homeowners more willing to take risks when borrowing. One regulatory change I would favor is to grant servicers the same type of business-judgment rule limited immunity from lawsuits that corporate directors presently enjoy, as a means to motivate servicers to exercise their judgment in good faith without fear of liability. *Cf.* Steven L. Schwarcz & Gregory M. Sergi, *Bond Defaults and the Dilemma of the Indenture Trustee*, 59 ALA. L. REV. 1037 (2008) (advocating this type of limited immunity for indenture trustees on public debt issues).

276. Misalignment also can result in a collective-action problem to the extent the originate-to-distribute model makes the size of any given loan-owner's investment so small that it deprives owners of the incentive to engage in due diligence and monitoring. MARK ADELSON, MBS BASICS (Nomura Sec. Int'l 2006). This Article's proposal to require loan originators to retain some material exposure to risk, however, would help to solve this collective-action problem.

277. *See supra* note 100 and accompanying text.

278. *See supra* notes 101–05 and accompanying text.

straightforward solution when in doubt of the servicer's integrity is to use an independent servicer.[279]

In practice, asset-backed securities transactions may evolve in the direction of more frequently using independent, third-party servicers to increase investor comfort.[280] This evolution is likely to be gradual because, at least currently, few independent parties have the needed servicing expertise and experience to cost-effectively perform in this capacity.[281] Nonetheless, there is evidence that the market is beginning to respond (such as the decision by Bank of America to purchase Countrywide Financial Corp.) partly in order to gain "greater scale in . . . servicing mortgages."[282]

If the market takes steps to correct itself in this manner, there should be no need for regulation requiring the use of independent servicers. Indeed, parties should have the flexibility to decide not to use independent servicers where they trust a servicer affiliated with the company originating the financial assets. There is nothing intrinsically wrong or unusual for parties in business transactions to deal with each other on the basis of trust.[283] And some transactions may be beneficial, even taking into

279. It will be interesting also to observe the extent to which investors gain comfort where the company is represented by a large, prominent, and highly respected law firm. The most agreed upon scholarly understanding of the value added by transactional lawyers is that, as repeat players in the transactional world, they add value by renting their good reputation to clients. This thesis of transactional lawyers as "reputational intermediaries" was first advanced in Ronald Gilson, *Value Creation by Business Lawyers: Legal Skills and Asset Pricing*, 94 YALE L.J. 239 (1984); *see also* Peter J. Gardner, *A Role for the Business Attorney in the Twenty-First Century: Adding Value to the Client's Enterprise in the Knowledge Economy*, 7 MARQ. INTELL. PROP. L. REV. 17, 46–48 (2003); Karl S. Okamoto, *Reputation and the Value of Lawyers*, 74 OR. L. REV. 15, 43 (1995). The rationale is that the high-reputation law firm bonds itself to good performance, losing at least part of its reputation if it fails to perform well. Indeed, a high-reputation law firm adds the greatest relative value when the client does not already have a high reputation.

280. *Cf.* People v. Serv. Inst., Inc., 421 N.Y.S.2d 325 (Sup. Court Suffolk County 1979) (holding that transactions in which defendant purchased a funeral home's accounts receivable at a discount and subject to repurchase by the funeral home and subject to further payments of service charges if the accounts were not repurchased within sixty days constituted loans at a rate of interest in excess of twenty-five percent per annum subject to usury law); SCHWARCZ, STRUCTURED FINANCE, *supra* note 47, § 4:5, at 4–9 (citing Lloyds & Scottish Fin. Ltd. v. Cyril Lord Carpets Sales Ltd., H.L. (Mar. 29, 1979)).

281. *See supra* note 100 and accompanying text.

282. Press Release, Bank of America, Bank of America Agrees to Purchase Countrywide Financial Corp. (Jan. 11, 2008).

283. *Cf.* Thierry Volery & Stan Mensik, *The Role of Trust in Creating Effective Alliances: A Managerial Perspective*, 17 J. BUS. ETHICS 987 (1998) (observing that trust plays a crucial role in creating and managing alliances because it reduces complex realities far more quickly and economically than prediction, authority, or bargaining).

account the increased possibility of fraud absent an independent servicer.[284]

The potential to ultimately impose this regulation might nonetheless be valuable. In the current financial environment, investors may call for independent servicers, but investors tend to have short memories. Experience has shown that once a crisis recedes in memory, they will almost always tend to "go for the gold."[285] There may come a time when regulation, or its threat, is needed to restore market discipline.[286]

Finally, misalignment can cause failure when conflicts exist among a firm's managers—such as when investment analysts resort to simplifying heuristics when analyzing highly complex securities[287] or manipulate models for their pecuniary advantage.[288] This can be addressed by better aligning management compensation incentives with the long-term interests of the firm[289]—such as retroactively recovering compensation paid to managers or paying a portion of compensation contingently over time or in the form of equity securities with long-term lock-down constraints on selling the securities.[290] Better alignment of compensation and firm interests also would have mitigated a similar problem of misalignment in

284. *Cf. supra* note 155 (discussing cost-benefit analysis).

285. Larry Light, *Bondholder Beware: Value Subject to Change Without Notice*, BUS. WK., Mar. 29, 1993, at 34 ("Bondholders can—and will—fuss all they like. But the reality is, their options are limited: higher returns or better protection. Most investors will continue to go for the gold."; discussing, in the context of but several years after the "Marriott split," that investors favor higher interest rates over "event risk" covenants once examples of events justifying the covenants have receded in memory, even though they could reoccur). Psychologists label the tendency of people to overestimate the frequency or likelihood of an event when examples of, or associations with, similar events are easily brought to mind as the availability heuristic. Paul Slovic, Baruch Fischhoff & Sarah Lichtenstein, *Facts Versus Fears: Understanding Perceived Risk*, *in* JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 463, 465 (Daniel Kahneman et al. eds., 1982).

286. *Cf. supra* notes 171–88 and accompanying text.

287. *See supra* notes 56–59 and accompanying text.

288. *See supra* notes 69–74 and accompanying text (discussing how investment analysts manipulated VaR modeling). *Cf.* Hu, *supra* note 3, at 1492 (discussing how a trader "engaged in derivatives operations may emphasize rewards and downplay risks").

289. *Cf.* CRMPG III REPORT, *supra* note 54, at 5 (observing that "more can be done to ensure that incentives associated with compensation are better aligned with risk taking and risk tolerance across broad classes of senior and executive management"). Sections 111(b)(2)(A)–(C) of the Emergency Economic Stabilization Act of 2008, Pub. L. No. 110-343 (2008) requires, in a limited context, that firms take a more long-term view to compensation to avoid conflicts in the way that managers are paid, receiving high compensations and bonuses for arranging deals or investments that later fail.

290. *See* Schwarcz, *Conflicts and Financial Collapse*, *supra* note 147, at 13 (examining these compensation alternatives in detail); *cf.* Arthur B. Laby, *Differentiating Gatekeepers*, 1 BROOK. J. CORP. FIN. & COM. L. 119, 159–60 (2006) (citing Tom Johnson, *The 2005 All-America Research Team*, INSTITUTIONAL INVESTOR, Oct. 1, 2005, at 54, 81) ("Sell-side analysts, for example, are generally not compensated based solely on investment performance. Buy-side firms rate, and presumably pay, sell-side analysts based on factors other than performance, including timeliness of information, responsiveness, innovation, and comprehensibility of research reports.").

hedge funds; certain losses of institutional investors in the subprime crisis appear to have resulted from losses in CDO investments by controlled or managed hedge funds.[291] Because managers of those hedge funds were paid according to hedge-fund industry custom, in which "fund managers reap large rewards on the upside without a correspondingly punitive downside,"[292] they had significant conflicts of interest with the institutions owning the funds.

Firms have incentives, and are in a better position than government regulators, to determine how best to align their long-term interests with manager compensation. Alignment is difficult to achieve, however, because individual firms that attempt to align incentives will be disadvantaged in their ability to compete for the best managers.[293] Regulation may well be needed to help resolve this collective-action problem.[294]

D. Regulatory Lessons

The foregoing analysis has shown that market participants themselves can, and indeed should have incentives to, address many of the market failures resulting from complexity. For example, market participants should have incentives to charge uncertainty premiums,[295] to draft servicing agreements with clearer and more flexible servicing guidelines,[296] to demand the use of independent third-party servicers,[297] and to require that loan originators retain a realistic risk exposure.[298] The analysis also has shown that unnecessary regulation should be avoided to minimize unintended, often adverse, consequences.[299]

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291. Kate Kelly, Serena Ng & David Reilly, *Two Big Funds At Bear Stearns Face Shutdown—As Rescue Plan Falters Amid Subprime Woes, Merrill Asserts Claims*, WALL. ST. J., June 20, 2007, at A1.

292. James Surowiecki, *Performance-Pay Perplexes*, NEW YORKER, Nov. 12, 2007, at 34.

293. Schwarcz, *Conflicts and Financial Collapse*, *supra* note 147, at 17.

294. *Id.*

295. *See supra* note 164 and accompanying text; William W. Bratton, *The Academic Tournament Over Executive Compensation*, 93 CAL. L. REV. 1557, 1561 (2005) (reviewing LUCIAN BEBCHUK & JESSE FRIED, PAY WITHOUT PERFORMANCE: THE UNFILLED PROMISE OF EXECUTIVE COMPENSATION (2004), which argues that corporate governance structures empower top managers to use their power over directors to extract rents described as incentive pay).

296. *See supra* notes 275–76 and accompanying text.

297. *See supra* notes 278–84 and accompanying text.

298. *See supra* notes 258–65 and accompanying text (through holding open a solution under which regulators require loan originators to retain that risk exposure).

299. *See supra* notes 115–16 and 161–63 and accompanying text. Indeed, chaos theory suggests that one unintended consequence of overregulation is that by preventing small financial-market collapses, it might divert attention from the potential for a greater systemic collapse. *Cf.* Ruhl, *supra* note 211, at 468 (observing that small collapses can enhance the stability of complex systems "the way

Nonetheless, there are specific areas in which regulation—or at least the threat of regulation—may well be necessary. Besides helping to resolve the collective-action problem discussed above,[300] regulation can limit the extent to which an investor crisis of confidence causes markets to collapse by allowing portfolio disclosure as an alternative to marking-to-market.[301] Regulation can require credit-derivative transactions to be centrally registered so that market participants have more information about counterparty risk.[302] Regulation also can speed the adoption of desirable market changes—for example, by eliminating the time needed for existing contracts to be replaced.[303] Similarly, as the lessons of the subprime crisis fade in the memories of investors, regulation might be needed to limit undue future reliance on mark-to-model valuation[304] and to ensure that investors give appropriate consideration to the need for independent third-party servicing[305] and avoid inappropriate exclusive reliance upon credit ratings.[306]

Because it is impossible to predict precisely how complexities might cause future evolving financial markets to fail, this Article offers no general prescriptive framework for regulating complexity per se. Nonetheless, the analysis has shown that regulators can generally mitigate the consequences of these failures by creating a market liquidity provider of last resort to decouple the risk of failures being systemically transmitted.[307]

To the extent regulators consider promulgating any of these regulatory responses, they should note that complexity inserts a particular twist into the ongoing debate over whether regulation should be rules-based or principles-based. The argument in favor of regulation based on principles is that investment securities and financial markets constantly change, often unpredictably,[308] and principles-based regulation is better suited to govern

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an area of tectonic activity might produce thousands of small tremors in order to avoid a severe earthquake"); *see generally* BAK, *supra* note 211 (first positing how small collapses can enhance complex system stability).

300. *See supra* notes 293–94 and accompanying text.

301. *See supra* note 204 and accompanying text.

302. *See supra* notes 181–84 and accompanying text (cautioning, however, that it is uncertain how useful this enhanced disclosure will prove).

303. *See supra* note 268 and accompanying text.

304. *See supra* note 171 and accompanying text.

305. *See supra* notes 285–86 and accompanying text.

306. *See supra* note 56 and accompanying text.

307. *See supra* notes 209–52 and accompanying text.

308. *Cf.* JOHNSON, JEFFERIES & HUI, *supra* note 123, at 3 (noting that fluctuations in evolving financial markets are difficult to model ex ante because previously observed statistical patterns do not always continue).

changing scenarios.[309] Rules could be overly constraining or could simply lose their effectiveness.[310]

Perhaps for this reason, the United Kingdom's Financial Services Authority (FSA) is moving to more of a principles-based approach.[311] Similarly, in the United States, the Financial Accounting Standards Board (FASB) is shifting GAAP from rules-based to more principles-based[312] and, to some extent, the emphasis of supervisory practices likewise appears to be shifting to a more principles-based approach.[313]

Principles-based regulation, however, is most appropriate in an interpretive community in which "the interpretive assumptions and procedures are so widely shared" by the regulator with the regulated parties (in our case, market participants) that the regulatory principles bear "the same meaning for all."[314] Without such shared assumptions and procedures, regulated parties will be unable to predict the consequences of their actions.[315] Regulators need information from industry to remain relevant, just as industry needs information from regulators to remain compliant.[316] To this end, "[m]any in the securities industry are calling for more principles-based regulation, linked with prudential oversight, to foster a consultative relationship between regulators and industry participants."[317]

This suggests a potential dilemma: as investment securities and financial markets become increasingly internationalized and more

309. Cristie L. Ford, *New Governance, Compliance, and Principles-Based Securities Regulation*, 45 AM. BUS. L.J. 1, 2 n.8 (2008) (citing the SEC's recent establishment of a principles-based definition and disclosure requirements for asset-backed securities).

310. *Id.* at 60 ("Principles-based regulation and outcome-oriented regulation are responses to a visceral recognition that traditional, rule-oriented legal regimes are limited in their ability to deal with some broader organizational and cultural problems.").

311. FINANCIAL SERVICES AUTHORITY, PRINCIPLES-BASED REGULATION, FOCUSING ON THE OUTCOMES THAT MATTER (Apr. 2007).

312. Financial Accounting Standards Board, *Proposal for a Principles-Based Approach to U.S. Standard Setting* (2002), http://www.fasb.org/proposals/principles-based_approach.pdf; Financial Accounting Standards Board, *FASB Response to SEC Study on the Adoption of a Principles-Based Accounting System* (2004), http://www.fasb.org/response_sec_study_july2004.pdf.

313. CRMPG III REPORT, *supra* note 54, at 137.

314. Julia Black, *Using Rules Effectively*, *in* REGULATION AND DEREGULATION 95, 100 (C. McCrudden ed., 1999).

315. *Cf.* Eilis Ferran, Professor of Co. and Secs. Law, University of Cambridge Faculty of Law, Comments at the University of Cambridge Conference on Principles v. Rules in Financial Regulation (Apr. 12, 2008) (expressing concern that, because its strategy is to enforce on the basis of principles alone, the FSA's assurance that firms will find it possible to predict the consequences of their actions will be "just empty words").

316. E-mail from Cristie Ford, Assistant Professor, University of British Columbia Faculty of Law and author of *New Governance, Compliance, and Principles-Based Securities Regulation*, 45 AM. BUS. L.J. 1 (2008), to the author (Apr. 19, 2008).

317. Elizabeth Derbes, The Subprime Crisis: U.S. Regulatory Responses and Lessons Learned ¶ V.B.3 (2008) (unpublished manuscript, on file with author).

complex, making principles-based regulation more attractive as a means to adapt given principles to different legal systems, it will become increasingly harder for regulators and market participants to act together as a community. That, in turn, will make principles-based regulation less effective. Regulators and market participants will have to remain cognizant of this limitation.

IV. CONCLUSIONS

As the subprime crisis has dramatically illustrated, complexity can be both beneficial and harmful. It is beneficial to the extent it adds efficiency and depth to financial markets and investments, such as by satisfying investor demand for securities that more closely meet their investment criteria and by facilitating the transfer of risk to those who prefer to hold it.[318] But it is harmful to the extent it triggers the market failures described in this Article, "mak[ing] crises inevitable."[319] Ultimately it is necessary to find a balance through market adaptation and, when needed, regulation.

This Article attempts to strike that balance. To this end, the Article first examines the ways in which complexity can cause markets to fail. For example, the complexities of the assets underlying investment securities and the means of originating those assets can lead to a failure of lending standards. The complexities of investment securities themselves can lead to a failure of investing standards and financial-market practices by impairing disclosure, obscuring the ability of market participants to see and judge consequences, and making financial markets more susceptible to financial contagion and to fraud. And the complexities of modern financial markets can exacerbate these market failures. Because these complexities have characteristics of complexities in engineering systems with nonlinear feedback and the failures themselves are characteristic of failures in those systems, the Article's analysis in part takes a law and engineering approach.

That approach reveals that, just as there are no general laws for complexity, there are no general laws for regulating complexity. Complexity not only makes it impossible to predict how future financial crises will arise but also makes it more likely that regulation can lead to unintended, and often adverse, consequences. To help solve this regulatory dilemma, the Article proposes, among other things, that regulators create a market liquidity provider of last resort having the power to invest in

318. *See supra* notes 5–10 and accompanying text.
319. BOOKSTABER, *supra* note 68, at 5.

securities of panicked markets or, as circumstances warrant, to hedge irrational elements of a market panic, thereby stimulating private investment in these securities.[320] By so stabilizing market prices—especially when those prices fall measurably below the intrinsic value of the securities, such as occurred in the subprime crisis[321]—such a market liquidity provider would address the very consequences of market failure, dampening the over-amplification of marking-to-market that can lead to market collapse and reducing systemic risk by decoupling the chance that a failure in one market will trigger a failure in other markets.

This solution takes inspiration from chaos theory and engineering design, which recognize that failures are almost inevitable in complex systems and that successful systems are those in which the consequences of a failure are limited. A market liquidity provider would work to limit the consequences of inevitable financial-market failures.

This Article's conception of a market liquidity provider of last resort for financial markets goes substantially beyond the traditional focus of the U.S. Federal Reserve and foreign central banks as lenders of last resort to financial institutions. An additional focus on markets is needed to reflect the increasing shift of corporate financing from banks and other financial institutions to financial markets.[322] Furthermore, because its mission is to correct market failure, a market liquidity provider should be able to invest profitably and still stabilize market prices.[323] This should not create a taxpayer burden—and indeed a market liquidity provider could be largely privately funded. Any moral-hazard costs are likely to be minimal, or at least substantially lower than the moral-hazard costs created by a lender of last resort to institutions. Moreover, a market liquidity provider could even minimize the moral-hazard problem of governments being forced to prop up financial institutions that are deemed "too big to fail."[324] A market liquidity provider, if institutionalized, also should work more effectively than ad hoc market-liquidity approaches such as those attempted during

320. *See supra* notes 244–52 and accompanying text (discussing market failures that deter private investment and how hedging can restimulate that investment).

321. *See supra* notes 206–07 and accompanying text (examining how to measure when prices of securities fall below their intrinsic value). This Article indeed proposes, to minimize moral hazard, that a market liquidity provider of last resort should consider providing market liquidity *only* when it believes it can profit or at least break even. A market liquidity provider's mission should be solely to correct market failures. *See supra* notes 233–36 and accompanying text.

322. The Obama Administration's recently proposed revised financial bailout plan appears to recognize this reality. *See supra* note 251 and accompanying text (observing that government backing of the market for distressed MBS is an important element of this plan).

323. *See supra* notes 233–34 and 245–46 and accompanying text.

324. *See supra* notes 231–38 and accompanying text.

the subprime crisis. Market stabilization is much easier to achieve at the outset of a panic, before it becomes a self-fulfilling prophecy cutting off credit and cratering the real economy.[325]

The solutions offered by this Article, along with the "law and engineering" approaches introduced, represent important first steps in helping to mitigate some of the harmful consequences of complexity without impairing the viability and importance of modern capital markets. Future study of complexity in financial markets may further benefit from ongoing engineering research, where a variety of modeling approaches are being employed to understand nonlinear interactive patterns.[326] Any regulation based on that research should nonetheless be approached with caution. An analysis based on models is dependent on the underlying assumptions, and we do not yet know enough about financial markets to be certain of the assumptions.[327]

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325. Contrast this Article's market-liquidity-provider concept with the ad hoc approaches over the past year of the Bush and Obama administrations. As discussed, the U.S. Treasury Department's proposal in September 2008 to use government money to purchase mortgage-backed securities issued by Fannie Mae and Freddie Mac was the first attempt by government to stabilize markets by purchasing securities. *See supra* notes 239–40 and accompanying text. These purchases, however, did not address the much larger problem of mortgage-backed securities that are not already effectively government guaranteed. The Emergency Economic Stabilization Act of 2008 also contemplated government purchases of mortgage-backed securities, but its funds were used for other purposes. Ross Kerber & Robert Weisman, *Bailout Retooled to Boost Lending*, BOSTON GLOBE, Nov. 13, 2008, at A1. The more recent Term Asset-Backed Securities Loan Facility, or TALF, contemplated investing government funds in certain consumer-asset-backed securities to reduce consumer financing costs. Scott Lanman & Sarah Mulholland, *Fed May Need to Recast TALF on Commercial Real Estate (Update2)*, BLOOMBERG (Feb. 23, 2009), http://www.bloomberg.com/apps/news?pid=20601068&sid=aeVjBaVLQNgY&refer=economy. And the Obama Administration presently appears to be considering an approach under which private investors purchase mortgage-backed securities with government hedging. *See supra* note 251 and accompanying text. Although these approaches are good beginnings, they may well be too little, too late. By waiting so long, it has become harder to stabilize markets because of the systemic impact of the subprime crisis. The real economy is shrinking and individuals are losing their jobs, making it more likely that obligors on assets backing even prime securities will default.

326. *See, e.g.*, Burkett et al., *supra* note 115 (discussing research in ecosystem engineering that uses a variety of modeling approaches to understand nonlinear patterns). For example, scientists have been using models to analyze lake eutrophication, a process in which excess nutrients (such as phosphorous created by pollution) within the lake stimulate growth of aquatic plants, in turn causing rapid and cascading changes that ultimately deplete the lake's dissolved oxygen. *Id.* at 360. Traditional linear models can significantly overstate acceptable phosphorous levels because such models disregard nonlinearities such as threshold and feedback effects. *Id.* These are the same types of nonlinearities that exist in financial markets.

327. *Cf. 10th William Taylor Memorial Lecture, Credit Markets and the Economic Crisis: Hearing Before the S. Comm. on Banking, Hous. and Urban Affairs*, available through Federal News Service (Oct. 16, 2008) or at http://banking.senate.gov/public/_files/LUDWIGSenateBankingHearingRecord_TaylorLecture_Final_092508.pdf (Oct. 16, 2008) (statement of Eugene Ludwig, Chief Executive Officer, Promontory Financial Group) (stating that "it is widely accepted" now that the subprime mortgage securitization models used by rating agencies and other market participants relied

on "insufficient data and faulty assumptions"); Karl S. Okamoto, After the Bailout: Regulating Systemic Moral Hazard 23 (Oct. 30, 2008) (unpublished draft manuscript, on file with author) (observing that underlying the subprime financial crisis "was an enormous [and unjustified] faith in the market's ability to analyze and measure risk"). Investor panic leading to the subprime crisis may have been triggered, ironically, by incorrect modeling assumptions. *Cf. supra* notes 85–86 and accompanying text (observing that, in the subprime crisis, the assumptions underlying valuation models for CDO and ABS CDO securities turned out to be wrong, triggering investor panic).