

# FRAGMENTATION NODES: A STUDY IN FINANCIAL INNOVATION, COMPLEXITY, AND SYSTEMIC RISK

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*This Article presents a case study in how complexity arising from the evolution and proliferation of a financial innovation can increase systemic risk. The subject of the case study is the securitization of home loans, an innovation which played a critical and still not fully understood role in the 2007-2009 financial crisis. The Article introduces the term “fragmentation node” for these transaction structures, and it shows how specific sources of complexity inherent in fragmentation nodes limited transparency and flexibility in ways that undermined the stability of the financial system. In addition to shedding new light on the processes through which financial innovations become so complex and how that complexity contributes to new sources of systemic risk, the Article considers the tools regulators will need to tackle these sources of systemic risk. The policy analysis shows that disclosure, a tool commonly used in financial regulation, will not suffice. At times, regulators should target these new sources of systemic risk directly by seeking to reduce the length and complexity of the chain connecting investor and investment. The Article suggests some modest steps regulators could have taken prior to the 2007-2009 financial crisis, such as a transaction tax targeting serial fragmentation nodes, to illustrate how such reforms might work in practice. It also explains why the dynamics revealed in this case study are almost certain to arise again, even if in slightly different form.*

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## INTRODUCTION

Two of the most pressing issues in financial regulation are systemic risk and the increasing complexity of the capital markets.<sup>1</sup> This Article sheds new

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1. See, e.g., Steven L. Schwarcz, *Regulating Complexity in Financial Markets*, 87 WASH. U. L. REV. 211, 212-13 (2009) (identifying complexity “as the greatest financial-market challenge of the future” and one of the three core causes of the 2007-2009 financial crisis); Hal S. Scott, *The Reduction of Systemic Risk in the United States Financial System*, 33 HARV. J.L. & PUB. POL’Y 671, 673 (2010) (“Going forward, the central problem for financial regulation . . . is to reduce systemic risk.”).

light on each of these issues and the connection between them through a case study of a particular financial innovation that played a key role in the 2007-2009 financial crisis—the securitization of home loans.

This examination comes at a critical juncture for systemic risk and its regulation. Many of the key reforms adopted in the Dodd-Frank Wall Street Reform and Consumer Protection Act<sup>2</sup> and other policy responses to the 2007-2009 financial crisis seek to increase the stability of the financial system by imposing new costs and restrictions on banks and other large financial institutions.<sup>3</sup> While such regulations may increase the stability of the financial institutions regulated, they also increase the economic gains from financial innovations that shift financing activities out of regulated institutions and into the capital markets. Securitization is precisely such an innovation. Securitization entails the pooling of a group of cash-producing assets, like home loans, into a newly created entity against which multiple classes of securities are issued. The structures created—which this Article calls “fragmentation nodes”—are a critical feature of the shadow banking system through which the capital markets provide close substitutes for goods and services historically provided by banks.<sup>4</sup> As a result, the economic gains from innovations like securitization are likely to be even greater in the years ahead than they were in the years leading up to the financial crisis. It also means that the reforms adopted to produce a more stable financial system are unlikely to achieve that aim unless complemented by efforts to address the corresponding changes they are likely to induce in the capital markets.

Even if inadequately addressed in the policy reforms adopted thus far, this point is not novel. There is a significant and growing body of literature on the interplay between the traditional banking sector and the capital markets and ways that we might extend the types of regulations used to limit systemic risk in the traditional banking sector to the capital markets.<sup>5</sup> This Article goes further. It argues that the shadow banking system not only gives rise to sources of systemic risk akin to those that arise in the traditional banking sector, but that it also gives rise to new sources of systemic risk for which we have no precedent.

This Article’s central claim is that specific sources of complexity inherent in fragmentation nodes—core features of the shadow banking system—impede

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2. Pub. L. No. 111-203, 124 Stat 1376 (2010) (codified in scattered sections of the U.S. Code).

3. See *infra* Part I.C.

4. Gary Gorton & Andrew Metrick, *Regulating the Shadow Banking System*, BROOKINGS PAPERS ON ECON. ACTIVITY, Fall 2010, at 261 (2010) (describing the central role played by the shadow banking system in the 2007-2009 financial crisis and identifying securitization as one of three core components of the shadow banking system); Erik F. Gerding, *The Shadow Banking System and Its Legal Origins* 11-18 (Aug. 23, 2011) (unpublished manuscript) (on file with author) (describing the growth of the shadow banking system and identifying securitization as the system’s “central artery”).

5. See *infra* Part I.B.

transparency and flexibility in ways that increase systemic risk. More specifically, it identifies particular sources of complexity inherent in fragmentation nodes; it explains why, as a theoretical matter, those sources of complexity may give rise to systemic risk as fragmentation nodes backed by a particular asset type spread; and it draws on evidence suggesting that the theorized sources of systemic risk became manifest and contributed to the 2007-2009 financial crisis. By focusing on sources of complexity that are likely to be present in other financial innovations that shift financing activities out of banks and into the shadow banking system, this Article suggests that these dynamics are likely to arise again. It also enables policymakers and market participants to identify new financial innovations as potentially troubling even if, superficially, they can be distinguished from the securitization vehicles backed by home loans that were central to the 2007-2009 financial crisis.

In addition to contributing to the conversation about systemic risk generally, this Article also draws upon and contributes to two more narrow bodies of work. One of these bodies consists of the numerous accounts of the processes through which the securitization of home loans contributed to the 2007-2009 financial crisis,<sup>6</sup> and the other body focuses on the interactions among financial innovation, complexity, and systemic risk more generally.<sup>7</sup> Premised on the commonly held assumption that the 2007-2009 financial crisis was the result of myriad causes, this Article seeks to complement rather than displace these alternative accounts.<sup>8</sup> Its contributions arise largely from its methodology. By approaching these issues through a case study of how the complexity that resulted as a particular financial innovation arose, evolved, spread, and became a significant source of systemic risk, it provides valuable new insights into the processes through which financial innovations become so complex, and it elucidates the challenges and opportunities facing regulators charged with reducing systemic risk.

The case study begins with a brief history of the evolution and proliferation of mortgage-backed securities (MBSs) and collateralized debt obligations

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6. See *infra* Part III and sources cited therein.

7. See, e.g., FRANK PARTNOY, *INFECTIOUS GREED: HOW DECEIT AND RISK CORRUPTED THE FINANCIAL MARKETS* (2d ed. 2009); Henry T.C. Hu & Bernard Black, *Debt, Equity and Hybrid Decoupling: Governance and Systemic Risk Implications*, 14 EUR. FIN. MGMT. 663 (2008); Schwarcz, *supra* note 1; Henry T.C. Hu, *Misunderstood Derivatives: The Causes of Informational Failure and the Promise of Regulatory Incrementalism*, 102 YALE L.J. 1457 (1993) (book review).

8. See, e.g., Viral V. Acharya et al., *Manufacturing Tail Risk: A Perspective on the Financial Crisis of 2007-2009*, 4 FOUND. & TRENDS FIN. 247, 292 (2009) (“There is no shortage of proximate causes of the financial crisis.”); Bill Thomas et al., *What Caused the Financial Crisis?*, WALL ST. J., Jan. 27, 2011, at A21 (“[T]he crisis was the product of 10 factors. Only when taken together can they offer a sufficient explanation of what happened . . .”).

(CDOs) backed by MBSs.<sup>9</sup> MBSs and CDOs are created through securitization transactions in which assets (mortgages and MBSs, respectively) are bundled together into a newly created entity against which securities are issued. This account draws attention to the fact that these complex transaction structures are the product of a series of incremental innovations that accumulated over time. The incremental nature of this process is critical to understanding how these transactions became so complex and why that complexity was not subject to greater regulatory or market scrutiny prior to the 2007-2009 financial crisis.

The case study introduces the term “fragmentation node” for the nexus of contractual and other arrangements put into place each time an MBS or CDO is consummated. This term draws attention to the way such transactions permanently transform the relationship between investor and investment, making it easier to conceptualize the ways that the spread of MBSs and CDOs fundamentally altered the landscape of the capital markets. The descriptive account also examines the attributes of fragmentation nodes that make them complex. Four specific sources of complexity are highlighted: (1) fragmentation, (2) the creation of contingent and dynamic economic interests in the underlying assets, (3) a latent competitive tendency among different classes of investors, and (4) the lengthening of the chain separating an investor from the assets ultimately underlying its investment. Identifying these specific sources of complexity is critical to the analysis that follows. While the term “complexity” appears often in descriptions of modern finance, it has been used accurately but loosely to describe a wide array of phenomena. Defining the complexity at issue more narrowly enables this Article to examine with greater precision the effects of that complexity.

The Article builds upon its descriptive foundation by examining how the identified sources of complexity contribute to two distinct sources of systemic risk—information loss and “stickiness.” Its approach to each merges theory about why the identified sources of complexity may be expected to give rise to the phenomenon, and why each phenomenon, in turn, may be expected to increase systemic risk, with evidence from the 2007-2009 financial crisis. More specifically, the Article shows how the spread of fragmentation nodes led to a pervasive loss of information about the quality of the underlying home loans and the value of MBS and CDO securities backed by them. This loss of information likely contributed to the bubbles that preceded the 2007-2009 financial crisis, and it set the stage for the paralyzing uncertainty which was central to the unfolding of the crisis. Similarly, coordination problems arising from the fragmentation and repackaging of economic interests in home loans made it exceptionally difficult to modify the terms of those loans, making the original

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9. Except when context otherwise requires, the term “CDO” is used in this Article to refer to CDO transactions in which MBSs constitute one of the primary underlying assets. The term “MBS” is used for transactions backed by residential mortgages, not commercial property.

terms of the loans more “sticky” than they would have been otherwise. The resultant stickiness in the original terms of the underlying loans increased the likelihood of foreclosure. The excess foreclosures that resulted caused home prices to fall further, setting off a feedback loop of rising defaults, more foreclosures, and further price declines. While these phenomena have been noted in other accounts of the crisis, this Article is the first to show how each arises from specific sources of complexity inherent in the packaging of home loans into fragmentation nodes.

The Article concludes by considering the type of policies that are likely to be effective in reducing these sources of systemic risk. Once we recognize the systemic consequences of the highlighted sources of complexity, we can appreciate why it may be appropriate, and perhaps even necessary, for regulators to target that complexity directly. Prior to the crisis, regulators could have done this by discouraging serial fragmentation nodes (like CDOs containing MBSs) and encouraging simpler alternatives (like covered bonds). Mindful of the risks inherent in regulatory interventions that encourage particular financial innovations and discourage others, the policy analysis suggests that such interventions may nonetheless be warranted in order to facilitate the effective functioning of the market forces upon which we have traditionally relied to produce a stable and efficient system for allocating capital. It also draws attention to the myriad ways that regulators may implement such policies without mandating or banning the use of any particular transaction structure.

The Article proceeds in four Parts. Part I provides an overview of systemic risk and its regulation, describing traditional approaches and the new challenges facing regulators. It briefly describes some of the key policy responses to the 2007-2009 financial crisis, and it situates the case study that follows within current debates about the regulation of systemic risk. Part II provides a descriptive account of how MBS and CDO transactions came to be and how they work. Securitization is not a recent financial innovation, and a number of legal scholars have provided rich accounts of the role of securitization in modern finance and associated legal issues.<sup>10</sup> This account complements the existing literature by taking a different approach to the subject. It focuses on the ways securitization transactions backed by home loans evolved and spread in response to market forces and other pressures. Part II also introduces the notion

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10. See, e.g., Claire A. Hill, *Securitization: A Low-Cost Sweetener for Lemons*, 74 WASH. U. L.Q. 1061 (1996); Edward M. Iacobucci & Ralph A. Winter, *Asset Securitization and Asymmetric Information*, 34 J. LEGAL STUD. 161 (2005); Kenneth C. Kettering, *Securitization and its Discontents: The Dynamics of Financial Product Development*, 29 CARDOZO L. REV. 1553 (2008); Lois R. Lupica, *Asset Securitization: The Unsecured Creditor's Perspective*, 76 TEX. L. REV. 595 (1998); Steven L. Schwarcz, *The Future of Securitization*, 41 CONN. L. REV. 1313 (2009); Steven L. Schwarcz, *Keynote Address: Understanding the Subprime Financial Crisis*, 60 S.C. L. REV. 549 (2009); Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, 93 MINN. L. REV. 373 (2008) [hereinafter Schwarcz, *Protecting Financial Markets*].

of a fragmentation node and identifies aspects of securitized transaction structures that make them complex.

Part III examines the two phenomena arising from the proliferation of fragmentation nodes that contribute to systemic risk—information loss and stickiness. This Part shows how the complexity of fragmentation nodes gives rise to each; it considers how each phenomenon may, in general, give rise to systemic risk; and it examines evidence of each phenomenon arising and creating problems in the 2007-2009 financial crisis. Part IV sets forth the Article's normative claim that, because complexity arising from the spread of financial innovations may contribute to systemic risk, it is an issue about which financial regulators should be concerned. This Part proposes specific regulations that might have been reasonable for regulators to implement prior to the 2007-2009 financial crisis had they been attuned to the dynamics highlighted here, and it explains why similar modes of intervention may be warranted in the years ahead.

### I. REGULATING SYSTEMIC RISK

Systemic risk may be understood as “the risk that the financial system will fail to function properly because of widespread distress.”<sup>11</sup> It has long been recognized that a failure in the functioning of the financial system imposes significant externalities, adversely affecting persons far removed from the financial institutions at the core of the crisis.<sup>12</sup> The long and deep recession that arose out of the 2007-2009 financial crisis served as a powerful reminder of these externalities and hence of the value of regulations that reduce systemic risk.<sup>13</sup> The crisis also revealed significant shortcomings in traditional approaches to regulating systemic risk. This Part examines the notion of systemic risk and evolving approaches to its regulation. It concludes by situating the case study that follows within current debates about systemic risk regulation.

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11. Jean Helwege, *Financial Firm Bankruptcy and Systemic Risk*, REGULATION, Summer 2009, at 24, 24; see also Hal S. Scott, *Reducing Systemic Risk Through the Reform of Capital Regulation*, 13 J. INT'L ECON. L. 763, 763-64 (2010) (explaining that “[s]ystemic risk can be defined in many ways,” including, “[m]ost broadly, . . . the risk that a national, or the global, financial system will break down”).

12. See CARMEN M. REINHART & KENNETH S. ROGOFF, THIS TIME IS DIFFERENT: EIGHT CENTURIES OF FINANCIAL FOLLY 224-25 (2009) (providing empirical data on the high costs of financial crises); see also MARKUS BRUNNERMEIER ET AL., THE FUNDAMENTAL PRINCIPLES OF FINANCIAL REGULATION, at xvii (Geneva Reports on the World Econ. 11, 2009) (“It is perhaps banal by now to point out that the reason why we try to prevent banking crises is that the costs to society are invariably enormous and exceed the private cost to individual financial institutions.”).

13. See, e.g., RICHARD A. POSNER, A FAILURE OF CAPITALISM: THE CRISIS OF '08 AND THE DESCENT INTO DEPRESSION, at xii (2009); Phillip Swagel, *The Cost of the Financial Crisis: The Impact of the September 2008 Economic Collapse* (Pew Fin. Reform Project, Briefing Paper No. 18, 2010), available at [http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Economic\\_Mobility/Cost-of-the-Crisis-final.pdf](http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Economic_Mobility/Cost-of-the-Crisis-final.pdf).

### A. *Traditional Approaches*

Many sources of systemic risk are well known, and tools designed to address those sources of systemic risk are well established. Historically, the paradigmatic source of systemic risk was a banking crisis.<sup>14</sup> This is because of the central role banks play in moving capital from savers to productive undertakings, and because of instability inherent in banks' structure. Banks tend to use short-term liabilities, like demand deposits, to fund long-term assets, like loans to small businesses, so even a solvent bank may lack the requisite funds if too many depositors demand their money back at the same time.<sup>15</sup> And because of the interconnectedness of banks and the potential for problems at one bank to signal problems at others, a run on one bank can lead to the failure of other banks and an overall contraction of the financial system. The potential for bank failures to result in a financial crisis is particularly great when there is a high degree of correlation in the risks to which banks are exposed, which increases the likelihood of numerous banks failing within a short period.<sup>16</sup>

Because bank failures were a primary source of systemic risk, many regulations designed to reduce systemic risk applied solely to banks, as traditionally defined, and sought to reduce systemic risk by reducing the likelihood that any individual bank would fail.<sup>17</sup> Capital adequacy requirements, which require each bank to hold a set amount of equity capital, usually established by reference to the size and riskiness of a bank's assets, are a classic form of systemic risk regulation. They reduce the likelihood of a financial crisis by increasing the ability of banks to withstand losses regardless of their source.<sup>18</sup>

As the cornerstone of efforts to reduce systemic risk, capital adequacy requirements also illustrate many of the challenges inherent in this endeavor. One drawback is that such regulations can impose significant costs. Requiring a bank to fund itself in a particular manner irrespective of the bank's preferences reduces the rate at which the bank puts capital to productive uses, and has other social costs.<sup>19</sup> A related issue is that these regulations do not, and are not de-

14. See Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 199 (2008) ("The classic example of systemic risk in this context is a 'bank run' . . .").

15. See Douglas W. Diamond & Philip H. Dybvig, *Bank Runs, Deposit Insurance, and Liquidity*, 91 J. POL. ECON. 401, 401-02 (1983) (describing this phenomenon, and why it may also therefore be rational for a depositor to demand his money back even if he believes his bank to be solvent if he expects other depositors in that bank to demand a return of their funds).

16. See, e.g., Viral V. Acharya et al., *Measuring Systemic Risk 3* (May 2010) (unpublished manuscript), available at <http://ssrn.com/abstract=1573171>.

17. See, e.g., BRUNNERMEIER ET AL., *supra* note 12, at 7 ("[R]egulation has been excessively focussed on seeking to improve the behaviour and risk management practices of individual banks . . .").

18. See, e.g., Scott, *supra* note 11, at 764.

19. See, e.g., RAGHURAM G. RAJAN, *FAULT LINES: HOW HIDDEN FRACTURES STILL THREATEN THE WORLD ECONOMY* 174-75 (2010); Scott, *supra* note 11, at 773-74; see also *infra* Part I.B.



signed to, eliminate the targeted source of systemic risk completely.<sup>20</sup> Because higher capital adequacy requirements simultaneously reduce the likelihood of bank failure and increase the social cost of the regulation, the aim of regulators is not to set requirements so high as to prevent any risk of a bank failure. Rather, their aim is to find a reasonable balance between these countervailing interests. This challenge is accentuated by the apples-to-oranges nature of the comparison, as the cost of restricting the flow of capital in ways that limit economic growth when times are good is not easily measured and compared with the risk of a fundamental breakdown in the system through which that capital flows.<sup>21</sup>

### B. *Systemic Risk and Its Regulation Today*

While bank failures remain an important source of systemic risk, changes in the roles played by banks and other financial institutions, greater integration between banks and capital markets in the process of financial intermediation, and other transformative developments in the capital markets have created an environment in which the potential sources of systemic risk have become far more numerous and diverse.<sup>22</sup> Among the most significant changes has been the dramatic growth of the shadow banking system, which not only enables the capital markets to provide services and products traditionally provided by banks but also changes the roles played by banks in the process of financial intermediation.<sup>23</sup>

At the same time, the notion of what constitutes a “systemic risk” has broadened. Geoffrey Miller and Gerald Rosenfeld, for example, have recently drawn attention to “intellectual hazard,” that is, “the tendency of behavioral biases to interfere with accurate thought and analysis within complex organizations,” as a source of systemic risk.<sup>24</sup> They explain that “[b]ecause [intellectual hazard] affects organizations that are large, interconnected, or linked to many

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20. See, e.g., BRUNNERMEIER ET AL., *supra* note 12, at xx (acknowledging that “we cannot hope to prevent crises completely”).

21. See, e.g., Scott, *supra* note 11, at 773-74 (describing “the difficult challenges facing regulators attempting to specify the appropriate amount of capital for a given quantum of risk”).

22. See Schwarcz, *supra* note 14, at 200 (“Although a chain of bank failures remains an important symbol of systemic risk, [as a result of] the ongoing trend towards disintermediation . . . , capital markets themselves are increasingly central to any examination of systemic risk.”).

23. See, e.g., Acharya et al., *supra* note 8, at 258-59; Tobias Adrian & Hyun Song Shin, *Money, Liquidity, and Monetary Policy*, 99 AM. ECON. REV. (PAPERS & PROC.) 600, 601 figs.1, 2, 3 & 4 (2009); Gorton & Metrick, *supra* note 4, at 261, 269; Gerding, *supra* note 4, at 4-5.

24. Geoffrey P. Miller & Gerald Rosenfeld, *Intellectual Hazard: How Conceptual Biases in Complex Organizations Contributed to the Crisis of 2008*, 33 HARV. J.L. & PUB. POL’Y 807, 810 (2010).

other similarly situated organizations,” and because it “poses a threat to the smooth, orderly, and efficient functioning of the world’s financial markets,” intellectual hazard is appropriately characterized as a systemic risk and one that regulators should seek to address.<sup>25</sup> Other academics have shown a similar willingness to apply the term “systemic risk” to a variety of phenomena, so long as they increase the probability or potential magnitude of a financial crisis.<sup>26</sup>

Simultaneous with this recognition of the diverse range of the potential sources of systemic risk has been an evolution in thinking about how best to reduce systemic risk. A core flaw in traditional approaches to systemic risk regulation revealed by the 2007-2009 financial crisis is the almost exclusive focus on trying to maintain the safety and soundness of individual financial institutions. As explained by a group of leading economists:

[The current approach to systemic regulation] implicitly assumes that we can make the system as a whole safe by simply trying to make sure that individual banks are safe. This sounds like a truism, but in practice it represents a fallacy of composition. In trying to make themselves safer, banks, and other highly leveraged financial intermediaries, can behave in a way that collectively undermines the system.<sup>27</sup>

This insight has led many academics and policymakers to recognize that in addition to “microprudential” regulations focused on individual institutions, regulatory efforts to manage systemic risk must also take a “macroprudential” approach focused on maintaining the stability of the financial system as a whole.<sup>28</sup>

Others have been even more critical in their assessments of capital adequacy requirements and of other efforts to reduce systemic risk by imposing costly new restrictions on banks and other regulated financial institutions. Steven Schwarcz has described regulatory responses that “focus on banks, not markets” as “anachronistic.”<sup>29</sup> In his view, because of “new trends in the global marketplace,” which “enable[] companies to access the ultimate source of funds, the capital markets, without going through banks or other financial intermediaries[, a]n exclusive bank-focused approach simply does not keep up with underlying changes in the financial system.”<sup>30</sup>

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25. *Id.* at 812-13; *see also id.* at 835.

26. *See, e.g.*, Amir E. Khandani, Andrew W. Lo & Robert C. Merton, *Systemic Risk and the Refinancing Ratchet Effect* 2-3 (Nat’l Bureau of Econ. Research, Working Paper No. 15,362, 2009) (identifying as a significant source of systemic risk the “ratchet effect,” whereby it is easier for homeowners to increase than to decrease the amount of leverage in their homes). *See generally* Schwarcz, *supra* note 14, at 197 (showing how definitions of systemic risk “are inconsistent in several ways” and noting that “[t]he only common factor in these definitions is that a trigger event causes a chain of bad economic consequences”).

27. BRUNNERMEIER ET AL., *supra* note 12, at xvii.

28. *See, e.g.*, Beverly Hirtle et al., *Macroprudential Supervision of Financial Institutions: Lessons from the SCAP 1* (Fed. Reserve Bank of N.Y., Staff Report No. 409, 2009).

29. Schwarcz, *Protecting Financial Markets*, *supra* note 10, at 374.

30. *Id.* at 374-75.

Gary Gorton goes further in his critique of capital adequacy requirements. Gorton draws attention to the potential for the shadow banking system to provide close substitutes for products and services traditionally provided by banks, as well as competition from foreign banks. In light of these alternatives, he argues that once the market “determine[s] the capital ratio [which banks should maintain, any] regulatory increase above this level will result in a decline in the size of the official banking system.”<sup>31</sup> In his view, enforcing capital adequacy requirements will result in less capital flowing through regulated banks and more capital flowing through alternatives, like the shadow banking system. According to Gorton, “The same argument about the uselessness of capital requirements applies to any restriction imposed on banks . . . where entry is not limited.”<sup>32</sup>

Even if one believes that capital adequacy requirements and other efforts to restrict risk-taking by financial institutions should continue to play a central role in limiting systemic risk, these critiques draw attention to an important, unintended consequence of such regulations. By making it more costly for banks and other regulated financial institutions to extend and hold loans, regulations that target banks increase the potential economic gains from financial innovations that enable financing activities traditionally performed by banks to move into markets or other less regulated domains.

A number of academics have drawn attention to this risk and have proposed some creative ways to try to minimize the regulatory discrepancy.<sup>33</sup> Nonetheless, significant work remains to be done on the issues that arise as financing and other activities shift out of banks and into the capital markets. This issue is all the more pressing in light of the policy reforms that have been adopted in recent years.

### C. *Policy Responses to the 2007-2009 Financial Crisis*

The Dodd-Frank Act and other policy responses to the 2007-2009 financial crisis impose a mix of reforms designed to reduce systemic risk. The majority of the reforms adopted involve increases in the stringency or scope of established tools for regulating systemic risk. Increases in the magnitude of capital adequacy requirements and other changes intended to increase their efficacy are

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31. GARY B. GORTON, *SLAPPED BY THE INVISIBLE HAND: THE PANIC OF 2007*, at 168 (2010).

32. *Id.* at 169.

33. See, e.g., John Geanakoplos, *Solving the Present Crisis and Managing the Leverage Cycle*, FED. RES. BANK N.Y. ECON. POL'Y REV., Aug. 2010, at 101, 104 (“[T]he best way to monitor leverage is to do it at the *security* level by keeping track of haircuts on all the different kinds of assets used as collateral, including in the repo market and in the housing market.”); Gorton & Metrick, *supra* note 4, at 284-89 (arguing that “[r]epos and securitization should be regulated because they are, in effect, new forms of banking, but with the same vulnerability as other forms of bank-created money” and proposing specific ways of doing so).

a centerpiece in these reforms.<sup>34</sup> As a result, there is reason to expect that the shadow banking system and financial innovations that enable funding activities to be moved from banks into the capital markets will continue to grow.

At the same time, aspects of the Dodd-Frank Act and other policy responses to the crisis are responsive to concerns about the limitations of traditional approaches to regulating systemic risk and the need for a more macroprudential approach to systemic risk regulation. Specific provisions of the Dodd-Frank Act directly target the structure of certain markets in ways designed to reduce systemic risk.<sup>35</sup> Moreover, the Dodd-Frank Act creates a new Financial Stability Oversight Council, which will consist of the heads of the leading financial regulators, as well as a new Office of Financial Research. These new bodies are specifically charged with identifying and working with other financial regulators to respond to new sources of systemic risk. Likewise, at the international level, aspects of the new Basel III framework for banking regulation are expressly designed to address macroprudential concerns, and a new Financial Stability Board has been formed to work with “national financial authorities and international standard setting bodies” to identify and respond to sources of systemic risk arising from markets, in addition to risks arising within large financial intuitions.<sup>36</sup>

As reflected in the important roles assigned to the Financial Stability Oversight Council, the Dodd-Frank Act serves more as a starting point than a conclusion in efforts to reduce systemic risk.<sup>37</sup> Success of the responses adopted

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34. See, e.g., Dodd-Frank Wall Street Reform and Consumer Protection Act § 171, 12 U.S.C. § 5371 (Supp. IV 2010) (requiring the appropriate federal banking agencies to establish minimum risk-based capital requirements and providing guidance as to how those standards should be established and implemented); BASEL COMM. ON BANKING SUPERVISION, *BASEL III: A GLOBAL REGULATORY FRAMEWORK FOR MORE RESILIENT BANKS AND BANKING SYSTEMS 2* (rev. ed. 2011), available at <http://www.bis.org/publ/bcbs189.pdf> (“The Basel Committee is raising the resilience of the banking sector by . . . rais[ing] both the quality and quantity of the regulatory capital base and enhanc[ing] the risk coverage of the capital framework.”).

35. See, e.g., Dodd-Frank Act §§ 711-774, Pub. L. No. 111-203, 124 Stat. 1376, 1641-1802 (codified in scattered sections of 7 and 15 U.S.C.) (imposing new restrictions on swap transactions).

36. *Overview*, FIN. STABILITY BD., <http://www.financialstabilityboard.org/about/overview.htm> (last visited Mar. 9, 2012); see also *History*, FIN. STABILITY BD., <http://www.financialstabilityboard.org/about/history.htm> (last visited Mar. 9, 2012); *Mandate*, FIN. STABILITY BD., <http://www.financialstabilityboard.org/about/mandate.htm> (last visited Mar. 9, 2012); cf. Jaime Caruana, Gen. Manager, Bank for Int’l Settlements, *The Challenge of Taking Macroprudential Decisions: Who Will Press Which Button(s)?*, Speech at the 13th Annual International Banking Conference (Sept. 24, 2010) (transcript available at <http://www.bis.org/speeches/sp100928.pdf>) (describing the ways Basel III seeks to address concerns about macroprudential regulation).

37. See, e.g., DAVIS POLK & WARDWELL LLP, *SUMMARY OF THE DODD-FRANK WALL STREET REFORM AND CONSUMER PROTECTION ACT, ENACTED INTO LAW ON JULY 21, 2010*, at i (2010), available at <http://www.davispolk.com/files/Publication/7084f9fe-6580-413b-b870-b7c025ed2ecf/Presentation/PublicationAttachment/1d4495c7-0be0-4e9a-ba77>

thus far depends crucially on the willingness of the new and newly empowered regulators to use their authority to address the myriad sources of systemic risk that were not addressed directly, and that may even be aggravated, by the other policy reforms adopted.

The three projects just described—identifying new sources of systemic risk, developing a macroprudential approach to systemic risk regulation, and understanding the effects of shifting financing activities out of regulated banks and into the capital markets—shape the case study that follows. The case study takes as its focus the complexity that resulted from the evolution and proliferation of a particular financial innovation and the ways the resultant complexity gave rise to two new sources of systemic risk. Underlying this focus is the expectation that financial innovation will continue and that the spread of financial innovations will often increase the complexity of the capital markets in ways akin to the sources of complexity which arose from the spread of MBSs and CDOs.

This Article's key contributions arise not just from its focus but also its methodology. By approaching these issues through a case study that begins with the origins of the financial innovation, the descriptive account that follows recreates the landscape as it would have appeared to regulators and market participants involved in this area. It thereby sets the stage for a pragmatic analysis of the sources of systemic risk that may have been visible to regulators (had they known what they were looking for) and the steps that regulators could have taken to address those sources of risk prior to the 2007-2009 financial crisis.<sup>38</sup>

## II. THE EMERGENCE OF FRAGMENTATION NODES

This Part introduces the subject of the case study—CDOs backed by MBSs. The descriptive account that follows shows that this highly complex financial innovation was not something that anyone set out to create. Rather, it evolved over time through a series of incremental steps. This Part also examines the nature of the complexity inherent in these innovative structures.

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-f786fb90464a/070910\_Financial\_Reform\_Summary.pdf (“By our count, the [Dodd-Frank] Act requires 243 rulemakings and 67 studies.”).

38. We will return in Part IV, below, to examine more closely the questions of how broadly the findings of this case study may be applied and the likelihood that the dynamics revealed will arise again.

## A. *Mortgage-Backed Securities*

### 1. *The early days*

The story of the current mortgage marketplace starts not with private banks but with the federal government.<sup>39</sup> One of the many policy goals pursued by the government in the wake of the Great Depression to improve the lives of average Americans was to increase homeownership.<sup>40</sup> Government programs, such as government guarantees of certain home loans, increased the willingness of banks to extend home loans, but many banks remained hesitant to become overly engaged in that business. A primary reason was the risk that a homeowner would prepay his home loan, either to move or because he had refinanced. As a result of this prepayment risk, the cash flows from a single home loan can vary dramatically, even if the principal is insured. Prepayment risk tends to be particularly troublesome for a holder of loans that have a fixed interest rate, as homeowners are most likely to refinance, and thereby repay such loans, when interest rates are low—precisely the circumstances when the holder least wants the loans to be repaid.

The government responded by continuing to explore new ways to encourage banks to make home loans. One of the most successful government programs, which grew and evolved over time, was the creation of government-sponsored entities (GSEs) Fannie Mae, Freddie Mac, and Ginnie Mae, which are authorized to acquire home loans and securitize them.<sup>41</sup> The process of securitizing a home loan entails the creation of a securitization vehicle, generally a trust, to which the GSE sells a pool of home loans that it has acquired from various banks engaged in the business of originating the loans. The trust obtains the cash to acquire the home loans by simultaneously issuing securities with certain rights to the cash flows coming from the underlying loans.<sup>42</sup> When a GSE sponsors a securitization, that GSE guarantees the principal on each of

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39. See 1 TAMAR FRANKEL, *SECURITIZATION: STRUCTURED FINANCING, FINANCIAL ASSETS POOLS, AND ASSET-BACKED SECURITIES* § 2.3, at 49 (Ann Taylor Schwing ed., 2d ed. 2005).

40. See, e.g., Christopher L. Peterson, *Predatory Structured Finance*, 28 CARDOZO L. REV. 2185, 2194-97 (2007) (stating that “[t]hroughout the 1930s the federal government took a series of steps to restart and expand [the mortgage-finance and housing-construction] industries” and describing each of these initiatives).

41. While limited secondary markets for mortgages had developed as early as the thirteenth century, it is generally recognized that the current market for mortgage securities developed in the wake of these government programs. See 1 FRANKEL, *supra* note 39, § 6.2, at 202-11 (describing the history and evolution of pooling mortgages).

42. While not discussed here, tax and regulatory considerations also play substantial roles in shaping the structure of securitization vehicles.

the loans underlying the transaction.<sup>43</sup> As a result, the MBS investor bears the prepayment risk, but the GSE bears the default risk.<sup>44</sup>

The first GSE-sponsored securitizations were pass-throughs. A pass-through structure provides each investor holding an MBS issued in the transaction a pro rata share of the interest and principal payments made on each of the home loans underlying the transaction.<sup>45</sup> In terms of securitization structure, these transactions are relatively simple. The cash flows coming in mirror the cash flows going out, and each investor holds an equivalent set of rights with respect to those cash flows. The GSE guarantee adds to the relative simplicity of the transaction by effectively eliminating the need for an investor to evaluate the credit risk inherent in the underlying loans and by giving a single entity an incentive to maximize the value of each loan in the event complications arise.

The insight at the core of securitization is that the party in the best position to originate a home loan (traditionally, a local bank) may not be in the best position to hold the risks and expected returns on that loan. Separating the two roles allows each to be played by the party best suited to that role.<sup>46</sup> While separating these roles may create value, it also creates a number of logistical challenges. One is the need to ensure that the originating bank remains diligent in determining whether to extend a particular home loan even when it is not directly exposed to its subsequent performance. The primary legal mechanism used to address this moral hazard is the purchase agreement, in which the originating bank makes numerous representations and warranties regarding the quality of the home loans being transferred and the processes employed by the bank in determining whether to extend each of the loans.

A second logistical challenge arising from the separation of origination and ownership was the need to have someone who could service the home loans. A home loan traditionally created an ongoing relationship between the bank that originated the loan and the borrower. It was to the bank that the borrower made

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43. CONG. BUDGET OFFICE, FEDERAL SUBSIDIES AND THE HOUSING GSES 9 (2001) (describing the way “Fannie Mae and Freddie Mac . . . effectively provide a guarantee of timely payment on MBSs” they issue).

44. Investors were still exposed to credit risk in that the GSE sponsoring the transaction may not have been financially capable of fulfilling its guarantee, but it was long assumed (and subsequently confirmed) that the U.S. government would never allow the GSEs to default. *See, e.g.*, JANET M. TAVAKOLI, STRUCTURED FINANCE AND COLLATERALIZED DEBT OBLIGATIONS: NEW DEVELOPMENTS IN CASH AND SYNTHETIC SECURITIZATION 126-27 (2d ed. 2008).

45. *See* Frederick C. Dunbar et al., *CDOs: Structure, Value and Causation Circa 2007*, in SECURITIES ARBITRATION IN THE MARKET MELTDOWN ERA: ACHIEVING FAIRNESS IN PERCEPTION AND REALITY 119, 123 (PLI Corp. Law & Practice, Course Handbook Ser. No. 18,567, 1990); Brent J. Horton, *In Defense of Private-Label Mortgage-Backed Securities*, 61 FLA. L. REV. 827, 836 n.45 (2009).

46. This is just one source of value creation arising from securitization. Another is diversification. Grouping together a pool of home loans reduces the cash flow variability, and may also be used to reduce the holder’s exposure to other risk factors, such as conditions specific to a geographic region, through diversification.

his monthly payments, it was to the bank the borrower turned in the event of changed circumstances that might require the terms of the loans to be revisited, and it was the bank that would foreclose and resell the home if the borrower defaulted. In order to meet this challenge, securitization vehicles retain a “servicer,” a party that specializes in servicing home loans, charged with these tasks.<sup>47</sup>

GSE-sponsored pass-throughs were an important advance in the mortgage market and remain a central fixture in that market today.<sup>48</sup> They provided a new option for investors and expanded dramatically the types of investors from whom capital for home loans could be obtained. Financial intermediaries recognized, however, that the market for mortgage securities could yet be expanded. One way financial intermediaries sought to expand the market was to increase the pool of investors to whom mortgage securities could be sold.<sup>49</sup> Because of prepayment risk, the stream of cash flows from a GSE pass-through could vary dramatically, making them ill-suited for many investors. If financial intermediaries could create securities offering more predictable cash flows and accommodate other needs of heterogeneous investors, the range of investors to whom mortgage securities could be sold could be increased dramatically. One response was the formation of securitization transactions backed by pools of GSE pass-throughs, rather than home loans, against which multiple tranches of securities were issued.<sup>50</sup> Each tranche was given a different set of rights to the cash flows from the underlying pass-throughs.

A second way financial intermediaries sought to meet the needs of diverse investors and to expand the market for mortgage securities was to increase the range of home loans that could be securitized. GSEs can only acquire and securitize loans that meet a number of criteria, including limitations on the duration of the loan, the ratio of the amount of the loan relative to the value of the home, and the absolute amount of the loan. Loans that do not meet all of these criteria,

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47. Core to making these transactions work is the fact that investors have rights to the cash flows coming from the mortgages but no direct stake in the mortgages themselves. This is critical because there are special limitations placed upon the ways in which real property interests may be divided and special policy issues that arise when interests in real property become too fragmented or are divided in nonstandardized ways. *See, e.g.*, MICHAEL HELLER, *THE GRIDLOCK ECONOMY: HOW TOO MUCH OWNERSHIP WRECKS MARKETS, STOPS INNOVATION, AND COSTS LIVES* (2008); Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The Numerus Clausus Principle*, 110 *YALE L.J.* 1 (2000).

48. *See* TAVAKOLI, *supra* note 44, at 126-28.

49. While under the idealized conditions postulated by Modigliani and Miller, this type of development would not have produced any net benefits, the reality of the financial marketplace strays far from that idealized world. *See* Ronald J. Gilson & Charles K. Whitehead, Essay, *Deconstructing Equity: Public Ownership, Agency Costs, and Complete Capital Markets*, 108 *COLUM. L. REV.* 231, 247-51 (2008).

50. These transactions are generally referred to as collateralized mortgage obligations and continue to have a significant place in the market for mortgage securities. *See* Dunbar et al., *supra* note 45, at 123.



such as jumbo loans, which are greater in amount than those a GSE is allowed to acquire, could not be sold to a GSE. In response, financial intermediaries created private-label MBSs, privately sponsored MBS transactions backed by home loans that do not conform to the GSE criteria.

## 2. *Private-label MBSs*

The first private-label MBS was issued by Bank of America in 1977. The federal government enacted legislation facilitating the issuance of private-label MBSs in 1984,<sup>51</sup> and the market for these securities expanded rapidly thereafter. Because home loans packaged into a private-label MBS are not guaranteed by a GSE, private-label MBSs pose credit risk in addition to prepayment risk. This was in some ways a significant development, giving rise to the need for the terms of the MBS to allocate credit risk in addition to prepayment risk. Yet, the magnitude of this credit risk was perceived to be small, both because of homeowner reluctance to default and the expectation that a significant portion of the value of a loan could be recovered through foreclosure even if a homeowner did default.

Both credit risk and prepayment risk are allocated among the different tranches of MBSs issued through “waterfall” provisions that set forth the rights of each of the different tranches. The general idea is to create a hierarchical structure in which losses on the underlying loans are allocated first to the subordinate tranches. This enables the creation of senior tranches that have very little credit risk. The processes through which these structures are created are not, however, as simple as the rationale for them.

While the terms of a securitization are static, the cash flows coming into a securitization vehicle are not. Each time a borrower misses a monthly payment, makes a double payment to accelerate the rate at which she pays down her loan, refinances, or defaults, the amount of cash coming into the securitization vehicle is affected. How these events influence the cash paid out of the securitization vehicle to the various tranches depends upon the terms of that particular transaction. These are just a few of the series of decisions the financial intermediary sponsoring an MBS must make at the time the transaction is put together. The sponsor must also decide what home loans to include in the MBS, the terms on which those loans will be acquired from the originators, how many different tranches of MBSs to issue, the size of each of those tranches, the interest rate that should be paid to each of those tranches, and so on. There is no cookie cutter that can be used to create these transactions.

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51. Secondary Mortgage Market Enhancement Act of 1984 (SMMEA), Pub. L. No. 98-440, 98 Stat. 1689 (codified in scattered sections of 12 and 15 U.S.C.); *see also* Edward L. Pittman, *Economic and Regulatory Developments Affecting Mortgage Related Securities*, 64 NOTRE DAME L. REV. 497, 497 (1989) (explaining the changes effectuated by SMMEA and noting that following its adoption, “the market for mortgage securities . . . increased dramatically”).

The range of options available to a financial intermediary sponsoring an MBS transaction is reflected in the variety of different mechanisms a sponsor may use to credit-enhance the senior tranches issued by that MBS. As just described, the primary means of credit enhancement is the use of a multitranche subordination structure. Typically, all of the losses on the underlying home loans are allocated first to the most junior (or “equity”) tranche, which for this reason is often referred to as the “first-loss” piece. If and when that tranche is wiped out, the second most junior tranche begins absorbing the losses, and the pattern repeats as needed.<sup>52</sup> While this type of rule is regularly used to allocate losses, there is no comparable uniform rule that must be used to allocate principal payments among the different tranches.

If a sponsor wants to minimize the credit risk to which the senior tranche is exposed, the sponsor can use a sequential amortization scheme. In that case, one hundred percent of the principal payments made on any of the underlying loans, including prepayments, are paid out to the most senior tranche of MBS outstanding until that tranche is repaid in full. At that time, the process repeats with all principal repaid going to the most senior tranche still outstanding. While such an approach minimizes credit risk, there are also drawbacks to using a strictly sequential waterfall. Because the rate at which the senior tranche will be repaid increases as prepayments increase, this type of waterfall exposes the senior tranche to significant prepayment risk. The terms of the more junior tranches of MBSs that result from this type of structure also may not be well suited to the needs of investors otherwise in a position to bear the additional credit risk posed by those tranches. Thus, while many MBS transactions continued to use this type of waterfall, financial intermediaries also experimented with an array of other mechanisms for distributing principal payments.<sup>53</sup>

The waterfall provisions may, for example, provide that the most senior tranche receives all of the principal payments until the earlier of a specified point in time (e.g., five years from the date of issuance) or the satisfaction of specified performance metrics. Once the enumerated condition is satisfied, the principal ceases to be distributed sequentially and is instead distributed pro rata among all of the tranches of MBSs still outstanding based upon the principal value of the MBSs.<sup>54</sup> The performance metrics are designed to ensure that the amount of credit enhancement in the securitization vehicle makes it probable that the shift to the pro rata allocation of principal will not expose the senior

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52. The junior tranches are compensated for the additional credit risk to which they are exposed through a higher interest rate.

53. See 1 FRANKEL, *supra* note 39, § 8.3.4, at 365 (describing pay-through MBS structures designed to offer “planned amortization class bonds” and “targeted amortization class bonds”).

54. Gary B. Gorton, *The Subprime Panic* 10 (Nat’l Bureau of Econ. Research, Working Paper No. 14,398, 2008).

tranches to too much credit risk.<sup>55</sup> In addition to being used as a trigger for shifting from a sequential to a pro rata amortization scheme, different performance metrics—ones indicating that the loans underlying a transaction are performing below expectations—may be used to cut off interest payments to subordinate tranches even before the aggregate losses have wiped out those tranches.

In addition to determining the bundle of cash flow rights that should be given to each of the tranches, a transaction sponsor may also create tranches with rights that fall outside this prioritized hierarchy. Common alternatives include interest-only and principal-only tranches, which have terms consistent with their names. By parsing more finely the type of risk to which the holder is exposed, these types of MBSs may be used by investors as hedges against other risks to which they may be exposed or as bets upon market movements.<sup>56</sup> Interest-only MBSs, for example, generally have no credit risk but substantial prepayment risk, so may be attractive to an investor who believes that interest rates are likely to increase and thus that prepayment speeds will be slower than the market anticipates (assuming that the loans underlying the transaction have fixed, rather than variable, interest rates).<sup>57</sup>

In conjunction with the structures described above, a variety of additional mechanisms may be used to provide further credit enhancement to the senior tranches. Some of these mechanisms are external to the securitization vehicle, such as letters of credit, guarantees, or insurance policies covering a portion of the MBSs issued.<sup>58</sup> For example, it became common prior to the financial crisis for all or a portion of the AAA-rated securities issued in a transaction to be insured by a AAA-rated insurance company.<sup>59</sup> So long as the amount paid for this insurance policy was less than the savings realized in the form of the lower interest rate that could be paid on the MBSs protected by the insurance, these policies made economic sense from the perspective of the transaction sponsor.

Other mechanisms for providing credit enhancement are endogenous to the securitization vehicle. The two most commonly used mechanisms are excess

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55. These metrics may include limitations on the aggregate value of defaults on the underlying pool of mortgages and the proportion of outstanding loans that are delinquent as of the measurement date. *Id.*

56. 1 FRANKEL, *supra* note 39, § 8.3.5, at 367 (describing securitization structures providing for interest-only and principal-only securities, and noting the ways each may be used to hedge different interest rate risks).

57. *See, e.g.*, REDWOOD TRUST, THE REDWOOD REVIEW 2ND QUARTER 2009, at 43 (2009) (describing a particular interest-only MBS investment, including risks and expected returns).

58. *See generally* 1 FRANKEL, *supra* note 39, §§ 9.2-9.6, at 360-70.

59. Karl S. Okamoto, *After the Bailout: Regulating Systemic Moral Hazard*, 57 UCLA L. REV. 183, 201 (2009).

spread and overcollateralization.<sup>60</sup> Excess spread arises when the cash flows coming into the securitization vehicle from the underlying home loans are greater than the amount of cash being paid out, including fees and interest payments to MBS holders (but excluding, in both directions, cash flows characterized as principal).<sup>61</sup> Overcollateralization arises when the face value of the assets (the underlying home loans) in a securitization vehicle exceed the face value of the MBSs issued by that vehicle.<sup>62</sup>

As this abbreviated introduction to MBS structures reflects, innovation within the field of mortgage securitization provided transaction sponsors with an almost endless array of spigots they could use in constructing the “waterfall” which determines when cash from the underlying home loans is paid out to each of the tranches of securities issued. By allowing transaction sponsors to partition risk more finely, and package that risk in different forms, these innovations enabled sponsors to create securities particularly suited to the individualized needs of different investors. At the same time, the use of multitranche structures and other credit-enhancement mechanisms increased the complexity of securitization structures and transformed the relationship between the investor and the assets underlying its investment. In contrast to a pass-through, the economic interest of an MBS investor in a loan underlying his investment is not fixed, but rather is dynamic and contingent on the performance of the other loans with which that loan is bundled and on the waterfall pursuant to which the cash flows from the loans are allocated among the various tranches.

To highlight that something new is created that permanently transforms the relationship between the underlying asset and the investors with economic rights to the cash flows from that asset, this Article introduces the term “fragmentation node” for the structure that is formed.<sup>63</sup> The term is a theoretical construct for the rights, responsibilities, and constraints set forth in all of the agreements entered into when a multitranche securitization transaction is consummated. It applies to all private-label MBSs and to the CDO transaction structures described below.

Notably, once a fragmentation node is put into place, it cannot be removed. As a result, a home loan, which started as a bilateral arrangement between two parties, becomes embedded in a complex web of arrangements which may

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60. See Gary Gorton & Nicholas S. Souleles, *Special Purpose Vehicles and Securitization*, in *THE RISKS OF FINANCIAL INSTITUTIONS* 549, 564 (Mark Carey & René M. Stulz eds., 2006).

61. See *id.*

62. See GORTON, *supra* note 31, at 98-99; Gorton & Souleles, *supra* note 60, at 560.

63. The term “node” has also been used in the growing body of literature examining network effects, which is starting to be applied to financial networks. The use of the term here complements—but is analytically distinct from—its use in that literature, as the qualifier “fragmentation” draws attention to what happens inside the node. See, e.g., Ross A. Hammond, *Systemic Risk in the Financial System: Insights from Network Science 2* (Pew Fin. Reform Project, Briefing Paper No. 12, 2009).

grant tens or even hundreds of investors an economic stake in that loan. By shifting attention away from the securitization transaction which creates these varied interests, and toward the landscape of the capital market post-transaction, the term “fragmentation node” facilitates consideration of the systemic consequences associated with the proliferation of these transactions. In light of the possibility for transactions in the aggregate to have systemic effects which are qualitatively different from the localized effects of any individual transaction, the ability to shift between analyzing the localized and systemic effects of this financial innovation is critical to developing a more complete understanding of the ramifications of its spread.

### B. *Toward More Complex Structures*

This Subpart describes some of the innovations and market forces that shaped the growth of the mortgage-security market in the years leading up to the financial crisis. It explains why subprime MBSs—a particular type of MBS—and CDOs backed by MBSs proliferated rapidly during this period. It also describes key features of these transaction structures.

#### 1. *Another type of innovation*

The preceding Part described myriad innovations enabling transaction sponsors to modify the terms of a securitization transaction to suit investor needs and to enable a broader array of home loan types to be packaged into fragmentation nodes. At the same time, another type of innovation was simultaneously contributing to the growth of the market for mortgage securities. This group of innovations included new techniques for modeling MBSs and related transactions, as well as the development of other tools facilitating the ability of financial intermediaries sponsoring securitization transactions, credit agencies rating them, and potential investors evaluating them to assess more easily the expected returns on the securities issued.

For example, one challenge in assessing the value of a security issued in a multitranche securitization transaction is that its value depends not only on the quality of the underlying assets and the terms of the waterfall, but also on the correlation among the performance of the underlying assets. If all of the underlying assets are likely to succeed or fail at the same time, the securitization structure does not enable the type of diversification which is key to reducing the likelihood that the senior tranche of securities issued will fail to perform.<sup>64</sup> A paper published by David Li in 2000 described a device, known as a “Gaussian copula,” which could be used to reduce dramatically the effort required to

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64. See Dunbar et al., *supra* note 45, at 137-39.

evaluate the relationships among the default risks of the assets in certain securitization transactions.<sup>65</sup>

Li's Gaussian copula enabled market participants to use a single number to capture the effect of these relationships among the underlying assets for each tranche of securities issued in a CDO, subject to certain assumptions and the availability of relevant data.<sup>66</sup> This radically reduced the effort required to evaluate the expected default rate and return on the securities issued. Views differ on the extent to which market participants understood the limitations inherent in this device.<sup>67</sup> There is little disagreement, however, on how widely used it became, and how critical its use was in enabling the growth of the MBS and CDO markets.<sup>68</sup> Other similar innovations and improvements in modeling techniques also played important roles in enabling the creation of even more complex fragmentation nodes.<sup>69</sup>

## 2. Market forces

In light of the myriad mechanisms MBS and CDO sponsors could build into waterfalls and the new tools available to them to assess the expected performance of the various securities issued, the primary factors shaping the growth of the MBS and subsequently CDO markets became market forces—the types of home loans available to be securitized and the willingness of investors to acquire the securities issued.

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65. Felix Salmon, *Recipe for Disaster: The Formula That Killed Wall Street*, WIRED, Feb. 23, 2009, at 419, 419, available at [http://www.wired.com/techbiz/it/magazine/17-03/wp\\_quant?currentPage=all](http://www.wired.com/techbiz/it/magazine/17-03/wp_quant?currentPage=all) (explaining that in the years immediately following its publication, “Li’s formula, known as a Gaussian copula function, looked like an unambiguously positive breakthrough, a piece of financial technology that allowed hugely complex risks to be modeled with more ease and accuracy than ever before”).

66. See Damiano Brigo et al., *Credit Models and the Crisis: Default Cluster Dynamics and the Generalized Poisson Loss Model*, 6 J. CREDIT RISK 39 (2010).

67. See DAMIANO BRIGO ET AL., CREDIT MODELS AND THE CRISIS, at xiv-xv (2010) (stating that “quant and academic communities . . . produced and witnessed a large body of research questioning the copula assumption” even prior to the 2007-2009 financial crisis, while recognizing that many popular media accounts of the crisis have suggested otherwise).

68. See Donald MacKenzie, *The Credit Crisis as a Problem in the Sociology of Knowledge*, 116 AM. J. SOC. 1778, 1803 (2011) (describing the adoption and spread of Li’s Gaussian copula); Sam Jones, *Of Couples and Copulas*, FT WEEKEND MAG., Apr. 25, 2009, at 30 (explaining the critical role played by Li’s Gaussian copula in the growth of structured finance and how it led to “CDOs built solely out of subprime mortgage debt bec[oming] the rage”); Salmon, *supra* note 65, at 419 (explaining that Li’s Gaussian copula function “was adopted by everybody from bond investors and Wall Street banks to ratings agencies and regulators,” enabling “traders to sell vast quantities of new securities, expanding financial markets to unimaginable levels”).

69. See FIN. CRISIS INQUIRY COMM’N, FINANCIAL CRISIS INQUIRY REPORT 72 (2011) (“As private-label securitization began to take hold, new computer and modeling technologies were reshaping the mortgage market.”).

Of these, perhaps the most significant was the strong investor demand for financial instruments with a AAA rating.<sup>70</sup> Because MBSs backed by subprime loans and CDOs backed in part by MBSs tended to offer particularly high yields relative to their rating, there was a particularly strong demand for these securities.<sup>71</sup> This demand transformed the marketplace, both directly and indirectly, as financial intermediaries sponsoring these transactions became increasingly creative in finding ways to feed this demand.<sup>72</sup>

One response of financial intermediaries sponsoring these transactions was to increase the rate at which they acquired loans, particularly subprime loans, which in turn influenced the rate at which originators extended such loans. Only six percent of the home loans originated in 2002 were subprime, compared with more than twenty percent by 2006.<sup>73</sup> Of the roughly \$1.2 trillion in subprime loans extended in 2005-2006, more than eighty percent were subsequently packaged into securitization transactions.<sup>74</sup> A second, closely related trend was the growth of the CDO market. As one source noted, “Although CDOs have existed since 1987, the market experienced significant growth during the period from 2000 to 2006. In 2004, there was approximately \$157.4 billion in global CDO issuance. In 2006, there was \$551.7 billion in issuance, a growth of approximately 250%.”<sup>75</sup>

These two trends are closely linked because CDOs were among the primary buyers of MBSs backed by subprime home loans, particularly the lower investment-grade tranches.<sup>76</sup> Because these tranches traditionally had been among the most difficult to sell, this demand led to a feedback loop with a particularly pronounced effect in the subprime area, in which CDOs and MBSs transactions proliferated in tandem.<sup>77</sup> In light of the importance of subprime MBSs and CDOs to the market for mortgage securities in the years leading into the 2007-2009 financial crisis, each is addressed below.

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70. See *Buttonwood: Not What They Meant*, ECONOMIST, Jan. 30, 2010, at 82 (explaining how the “Basel rules, designed to ensure that banks have enough capital to cope with economic crises, . . . created an incentive for banks to hold AAA-rated securities”); Ben S. Bernanke et al., *International Capital Flows and the Returns to Safe Assets in the United States, 2003-2007*, at 7-13 (Bd. Governors Fed. Reserve Sys., Int’l Fin. Discussion Paper No. 1014, 2011).

71. See RAJAN, *supra* note 19, at 135.

72. See Eamonn K. Moran, *Wall Street Meets Main Street: Understanding the Financial Crisis*, 13 N.C. BANKING INST. 5, 33 (2009); Bernanke et al., *supra* note 70, at 13-15.

73. *Subprime Lending: Rising Damp*, ECONOMIST, Mar. 10, 2007, at 69.

74. See Gorton, *supra* note 54, at 6.

75. Faten Sabry & Chudozie Okongwu, *How Did We Get Here? The Story of the Credit Crisis*, J. STRUCTURED FIN., Spring 2009, at 53, 61.

76. See FIN. CRISIS INQUIRY COMM’N, *supra* note 69, at 128-30 (explaining how “CDOs [became] the dominant buyers of the BBB-rated tranches of mortgage-backed securities” and the effects of this shift).

77. See INT’L MONETARY FUND, *RESPONDING TO THE FINANCIAL CRISIS AND MEASURING SYSTEMIC RISK* 87 (2009); Dunbar et al., *supra* note 45, at 126; MacKenzie, *supra* note 68, at 1822-23.

### 3. *Subprime MBSs*

While the process of constructing an MBS backed by traditional home loans requires a notable degree of customization, the process becomes significantly more complicated as the complexity of the underlying loans increases. In part because of the additional credit risk associated with home loans extended to borrowers with poor credit histories, the defining characteristic of subprime loans, such loans often have a number of complicating features. Subprime loans are often structured as hybrid loans, with a low, fixed interest rate for the first two or three years (a “teaser” rate), and a higher variable interest rate thereafter.<sup>78</sup> As a result, subprime borrowers often have a strong incentive to try to refinance after only two or three years. The tendency for many subprime home loans to be refinanced within a few years of origination shaped the terms of the securitization vehicles into which they were packaged. As described by Gary Gorton:

Subprime securitizations are very different from standard securitizations because the refinancing of the underlying subprime mortgages provides the securitization with a lot of cash, which can be used to build-up credit enhancement over time. It does this by storing cash in the securitization and by amortization, which builds up the lower-rated tranches’ thickness over time. But, this dynamic credit enhancement depends on the subprime mortgages refinancing.<sup>79</sup>

Thus, the performance of MBSs backed by subprime loans depends upon the ability of each homeowner to refinance and prepay in full his current loan. A homeowner’s ability to do so depends, in turn, on the value of the home at the time he seeks to refinance, as well as prevailing credit conditions.<sup>80</sup> As a result, the performance of subprime loans and MBSs backed by subprime loans are much more sensitive to the housing market than more traditional home loans and MBSs.

A related effect is that subprime MBSs tend to be far more complex than other private-label MBSs. Balancing the need to provide the senior tranches with sufficient credit enhancement to warrant a high rating from a credit rating agency with the need to provide adequate expected returns to attract buyers to the more junior tranches—while also creating a structure that can absorb the expected onslaught of early prepayments—requires complicated mechanisms to be built into the waterfall provisions of each transaction. As a result, the waterfall provisions of a subprime MBS typically contained myriad triggers relating

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78. Statement on Subprime Mortgage Lending, 72 Fed. Reg. 37,569 (July 10, 2007); Oren Bar-Gill, *The Law, Economics and Psychology of Subprime Mortgage Contracts*, 94 CORNELL L. REV. 1073, 1076 (2009).

79. Gorton, *supra* note 54, at 12.

80. The likelihood a subprime mortgagor who cannot refinance will default, and the likelihood that the default will result in a loss to the holder of the loan, are also increased by another common feature of subprime mortgages—the down payment is often low or non-existent. Bar-Gill, *supra* note 78, at 1076.



to the age of the securitization vehicle, the amount of overcollateralization, and other performance metrics.<sup>81</sup>

The intricacy of these waterfall provisions highlights the complexity of the deal struck among the holders of the different tranches of an MBS regarding the rights of each tranche to cash flows coming from the underlying home loans. As in other private-label MBSs, the deal struck is not that the holders of the most senior tranche always win out over the holders of other tranches no matter what the cost or effect on those tranches. Rather, the most senior tranche has priority over the other tranches only to the extent set forth in the terms of that particular MBS. This finely tuned allocation of rights is key to the success of securitization, for the protections provided to the more junior tranches are key to attracting investors willing to acquire those securities.

#### 4. *CDOs and beyond*

CDOs are securitization transactions, like MBSs, but may be backed by a range of different debt instruments.<sup>82</sup> At issue here are CDOs backed exclusively or in significant part by MBSs. The process of creating such a CDO is similar to the process of creating an MBS. A securitization vehicle is formed that acquires cash-producing assets with capital it receives from issuing multiple tranches of securities. Cash flows, in the form of interest and principal from the underlying assets, come into the securitization vehicle. That cash is then paid out to investors or retained in the vehicle pursuant to detailed waterfall provisions put into place when the transaction is consummated. Because the assets underlying a CDO are more diverse and complex than the home loans underlying an MBS, the process of compiling assets and designing waterfalls to determine when interest and principal are to be paid to investors is often even more complex than the process described above. Moreover, just as with MBS transactions, those terms are customized to each transaction.<sup>83</sup>

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81. See Gorton, *supra* note 54, at 10-12.

82. TAVAKOLI, *supra* note 44, at 117. This Article also takes the position that, for relevant purposes, CDOs should not be seen as analogous to actively managed financial institutions. The critical distinction—the lack of active management at the level of the node—is pivotal with respect to each of the phenomena identified in Part III. Cf. Markus K. Brunnermeier & Martin Oehmke, Complexity in Financial Markets 5 (Sept. 10, 2009) (unpublished manuscript), available at <http://www.princeton.edu/~markus/research/papers/Complexity.pdf> (“If one were to value Goldman Sachs ‘bottom-up’, i.e. by considering each of Goldman Sachs’s businesses, their positions, projected cash flows and their risk profile, the resulting exercise would likely be *at least as complex* as coming up with a price for the tranche of a CDO.”).

83. See Gorton, *supra* note 54, at 14 (“There is no standardization of triggers across CDOs. Some have sequential cash flow triggers, others do not. Some have [overcollateralization] trigger calculations based on ratings changes; others do not. There is no straightforward template.”).

Another important difference between MBSs and CDOs in practice was the mode of distribution. While many MBSs were distributed through public offerings, CDOs were generally distributed through private placements pursuant to an exemption that enables the securities issued to be resold even if they have not been registered pursuant to the Securities Act of 1933.<sup>84</sup> One criterion to qualify for this exemption is that all of the investors to whom the securities are offered must be qualified institutional buyers (QIBs). QIBs are generally required to have at least \$100 million in investable assets.<sup>85</sup> As a result, CDO investors were almost exclusively institutional investors with substantial assets and resources who were presumed under applicable securities laws to be capable of looking out for themselves.

Despite their complexity, CDOs comprised of other securitized assets, like MBSs, were not the end of the story. Financial intermediaries continued to add additional fragmentation nodes along the same chain, forming so-called CDOs squared (CDOs<sup>2</sup>), which included CDO securities among their assets, and even CDOs cubed (CDOs<sup>3</sup>). The main rationale underlying these transactions was the same as that underlying the creation of CDOs—because the price differential between highly rated structured products and lower-rated structured products was greater than was justified by differences in their assessed credit risk, transforming lower-rated securities into higher-rated ones could create value.<sup>86</sup>

Another major area of innovation was the introduction of hybrid and synthetic CDOs. Synthetic CDOs are backed by a pool of credit default swaps referencing MBSs or other assets, rather than actual cash-producing assets.<sup>87</sup> Credit default swaps are bilateral agreements which require each party to the agreement to make payments to the other depending upon the performance of an agreed-upon reference security. The swaps underlying synthetic CDOs were designed to mimic the performance of reference MBSs or other debt instruments. Because each swap was a bilateral agreement, for a synthetic CDO to take a long position (effectively betting that home loans would continue to perform), there had to be an investor willing to take the short position (betting that home loans would underperform relative to market expectations). Synthetic CDOs, accordingly, served two markets simultaneously. The synthetic CDOs satisfied the market demand for mortgage securities while investors who wanted to short the mortgage market (because they believed that the market

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84. 17 C.F.R. § 230.144A (2009).

85. *See id.*; *see also* William K. Sjostrom, Jr., *The Birth of Rule 144A Equity Offerings*, 56 UCLA L. REV. 409, 426 (2008).

86. A notable flaw in this reasoning is that not all credit risk is equal. Even if a AAA-rated CDO and a AAA-rated corporate bond have the same expected default rate, the corporate bond poses relatively more idiosyncratic risk and should, accordingly, be more highly valued by investors who can reduce their exposure to that risk through diversification. *See* Joshua D. Coval et al., *Economic Catastrophe Bonds*, 99 AM. ECON. REV. 628 (2009).

87. Because synthetic CDOs are not the focus of this Article, what is provided is a simplified and somewhat stylized account of how synthetic CDOs work.

was overpriced or to hedge against other investments they held) could do so by acting as a counterparty to one or more of the underlying swaps. A related product, the hybrid CDO, is backed by a combination of cash-producing assets and credit default swaps. An extensive analysis of the growth of these markets and the distinct issues presented by these transactions is outside the scope of this Article. It suffices to note that each was yet another example of an innovation that built off a framework that had already gained acceptance in the marketplace.

An example of how the developments just described translated into practice is provided by Kenneth Scott and John Taylor based on their examination of the details of several CDOs. They found:

One example is a . . . CDO<sup>2</sup> created by a large bank in 2005. It had 173 investments in tranches issued by other pools: 130 CDOs, and also 43 [collateralized loan obligations] each composed of hundreds of corporate loans. It issued \$975 million of four AAA tranches, and three subordinate tranches of \$55 million. The AAA tranches were bought by banks and the subordinate tranches mostly by hedge funds.

Two of the 173 investments held by this CDO<sup>2</sup> were in tranches from another billion-dollar CDO—created by another bank earlier in 2005—which was composed mainly of 155 MBS tranches and 40 CDOs. Two of these 155 MBS tranches were from a \$1 billion [residential-]MBS pool created in 2004 by a large investment bank, composed of almost 7,000 mortgage loans (90% subprime).<sup>88</sup>

This example illustrates the extent of fragmentation, the level of complexity inherent in these transactions, and the tendency for each of these effects to compound with the addition of each serial fragmentation node. The degree of fragmentation becomes evident by taking the perspective of one of the seven thousand subprime borrowers. His loan was pooled with seven thousand other home loans in a highly complex MBS structure, which likely used overcollateralization and other dynamic credit-enhancement mechanisms. As a result, the rights of any MBS holder to the interest and principal that homeowner is paying depends in part on whether the seven thousand other homeowners are making their payments on time. Moreover, some of the securities issued in that MBS transaction went through a second fragmentation node—the billion-dollar CDO created by another bank earlier in 2005—at which stage, the cash flows from those MBSs were pooled with cash flows from 154 other MBS tranches and 40 CDOs, and then allocated according to another complicated waterfall. Then, some of the securities issued in that transaction went through yet another fragmentation node—the CDO<sup>2</sup> described—at which stage, the cash flows (which still include payments made by the original subprime homeowner) were pooled with cash from 130 CDOs and 43 collateralized loan obligations and then allocated among the various tranches issued in that CDO<sup>2</sup> pursuant to yet

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88. Kenneth E. Scott & John B. Taylor, Op-Ed., *Why Toxic Assets Are So Hard to Clean Up*, WALL ST. J., July 20, 2009, at A13.

another complicated waterfall. To identify, much less gather together, all of the persons with an economic stake in that home loan would be a nearly impossible feat. At the same time, from the perspective of an investor in the CDO<sup>2</sup>, he has only a minor stake in the performance of that particular loan, and now has layers upon layers of additional information regarding the structure of the CDO<sup>2</sup>, the structure of the other securitization vehicles issuing securities packaged into the CDO<sup>2</sup>, and the almost countless assets underlying all of those transactions, all of which are also relevant to the performance of his investment.

### C. *A Changed Landscape*

The previous Subpart provided a brief account of the mortgage securities landscape just prior to the 2007-2009 financial crisis and the key market forces shaping the development of that landscape. This Subpart completes the account. Because the term “complexity” is often invoked, accurately but unhelpfully, to describe a wide array of different transactions and effects, developing a more nuanced understanding of the nature of the complexity at issue is critical to enabling a meaningful analysis of its effects. This Subpart begins by identifying four specific sources of complexity inherent in fragmentation nodes. It then considers the processes through which fragmentation nodes evolved and spread. Finally, it complicates the account told thus far by acknowledging the many forces that may have influenced the evolution and proliferation of fragmentation nodes but that do not create value even on a localized basis.

#### 1. *Understanding the complexity*

Taking a step back, we can see that additional complexity was introduced at each of the stages in the evolution of mortgage securities described above. Four specific sources of complexity inherent in all fragmentation nodes merit particular attention.

The first is fragmentation. Each of the securitization transactions described above creates fragmented economic rights with respect to the assets underlying that securitization. As a result, each MBS or CDO investor generally has only a small economic stake in the performance of any particular asset underlying that investment. The magnitude of this reduction compounds with each additional fragmentation node that is added to the chain connecting the home loan to the ultimate investor. A simple example illustrates: If the holder of an MBS has a 5% interest in the cash flows coming from a particular loan, and that holder is itself a CDO which grants each of its investors a 5% stake in the cash flows coming into that CDO securitization vehicle, each CDO investor would have an economic stake of only 5% of 5%, or 0.25%, in the performance of each underlying loan.

This hypothetical, of course, obscures the effect of having different tranches. The creation of prioritized claims in the form of tranches, each hold-

ing a different set of rights with respect to the cash flows coming from the underlying assets, enables the creation of securities with less credit risk than the assets underlying a securitization transaction. Multitranche structures also enable the creation of securities with very specific characteristics. Because of investor heterogeneity, this customization has the potential to increase the efficiency of the capital markets and lower the cost of capital to those in need of it. At the same time, by giving different investors different sets of rights, these structures give rise to a variety of challenges.

Hence, a second source of complexity arising from multitranche structures is the dynamic and contingent nature of the economic interest held by an MBS or CDO investor with respect to the performance of any particular asset underlying its investment. Because of credit enhancement, the nonperformance of an underlying asset, be it a mortgage or MBS, may have no effect on the cash flows paid to holders of a senior tranche issued in a securitization. The amount of credit enhancement supporting that senior tranche will decrease each time an asset fails to perform in accordance with its terms, but whether that failure adversely affects the cash paid to holders of that senior tranche depends upon the performance of the other assets underlying that transaction.

A third, closely related source of complexity is the creation of divergent, and potentially competitive, economic interests with respect to the performance of any particular asset. A latent competitive tendency is inherent in any multitranche structure when the triggers in the waterfall that determine the rights of each tranche to the cash coming into the securitization vehicle are fixed by reference to the original terms of the underlying cash-producing assets. When an asset is placed into such a securitization vehicle, there is no longer one holder with a direct interest in maximizing the value of that asset, or even a group of holders, each with fractional but equivalent economic stakes; rather, there are multiple holders, each of which may be differently affected depending upon how the terms of the asset are modified. As a result, if a situation arises that was not contemplated at the time the underlying asset was created, different investors may be expected to have divergent preferences regarding the appropriate response.

The fourth and final source of complexity is simply the lengthening of the chain separating the original cash producing asset (the home loan) and the ultimate investor with economic rights to the cash flows coming from that asset. The addition of serial fragmentation nodes in the chain separating those two ends may have a particularly pernicious effect on the ability of a person sitting at one end to see through to or effect changes at the other end as a result of each of the other sources of complexity just described. But, even without the additional challenges created by fragmentation nodes specifically, the lengthening of the chain may in itself contribute to reduced visibility and other issues.<sup>89</sup>

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89. See Hu & Black, *supra* note 7, at 691 (“The longer the ownership chain . . . the greater the potential for agency costs and valuation errors to creep in.”).

Drawing attention to the specific sources of complexity inherent in fragmentation nodes enables a more precise analysis of the effects of that complexity, including the mechanisms through which that complexity contributes to systemic risk. This discussion also lays the groundwork for determining whether other financial innovations identified as complex are likely to produce similar effects, thus meriting the attention of regulators concerned about systemic risk.

## 2. *The process of financial innovation*

The preceding descriptive account also provided an overview of the processes through which fragmentation nodes came to be, evolved in form, and proliferated. These processes are informative both as they relate to fragmentation nodes and as illustrative of the ways in which financial innovations arise, evolve, and spread more generally. Again, a couple of patterns merit attention.

One is that the growth of complexity occurred along two axes. The first axis relates to the complexity of the individual transaction structures and the securities created by those transactions. The second axis relates to the spread of fragmentation nodes arising from the consummation of those transactions. The proliferation of fragmentation nodes altered the landscape of the capital markets, increasing the markets' complexity in ways not captured by the heightened complexity of any particular transaction. As a result, as we will explore further in the next Subpart, when a financial innovation becomes sufficiently pervasive, the resultant complexity may have systemic consequences which are qualitatively different from the localized effects of any individual transaction.

A second pattern revealed in the preceding account is that complexity increased along each of these axes in an incremental fashion. Had a financial intermediary tried to sell the securities issued by the complex CDOs<sup>2</sup> described by Scott and Taylor to investors with no familiarity with mortgage securities, it almost assuredly would not have found any buyers. But the financial intermediary sponsoring that transaction did not create it out of whole cloth—it used features to which investors had become accustomed incrementally over time. Looking back, we can see that financial intermediaries, investors, and regulators became accustomed first to pass-throughs, then simple private-label MBSs, then more complex MBSs, then subprime MBSs, and so on.

The incremental nature of this evolution was key to enabling the complexity that developed. An investor accustomed to investing in pass-throughs who is then presented with a private-label MBS, for example, may not have questioned whether using a servicer could affect the cash flows coming from a mortgage, because the use of such agents was an innovation to which that investor had already become accustomed. Similarly, once that investor became accustomed to investing in private-label MBSs, that investor may have questioned the additional risks posed by the inclusion of risky mortgages in a subprime MBS, but might not revisit the question of whether purchase agreements could be relied upon to ensure mortgage originators had engaged in appropriate due diligence

in determining whether to extend a loan packaged into an MBS. Nor would such an investor be likely to scrutinize a gradual increase in the number or diversity of tranches issued in MBS transactions. Similarly, regulators who witness this evolution may not step back and question whether the evolution and proliferation of a financial innovation might have systemic effects that vary, qualitatively, from the issues associated with any particular incremental innovation or any individual transaction. In general, there may be a tendency for all involved to examine closely only the issues raised by the most recent incremental change.

The incremental nature of the processes through which financial innovations become highly complex is critical to understanding how that complexity develops and why that complexity itself may not be subjected to close scrutiny by market participants or regulators. Despite its importance, this issue has been largely overlooked in other accounts of the 2007-2009 financial crisis or financial crises more generally.<sup>90</sup>

A final note about the processes through which these innovative transactions spread is the role played by other financial innovations. Li's Gaussian copula and innovations in modeling provided market participants and regulators with a plausible basis for believing that the complexity, while great, was manageable.<sup>91</sup> While the extent of reliance on such tools has been the subject of heated debates in the wake of the crisis, it is clear that many of these developments were genuinely valuable innovations, and it is equally clear that at least some market participants and regulators believed, to a fault, in the capacity of such innovations to render the risks inherent in even the most complicated new financial instrument knowable. In other words, it was not just the incremental nature of these processes that helped enable the complexity that resulted, but also the availability of a story that market participants could tell themselves about why the resultant complexity need not be a source of concern.

### 3. *Other factors shaping these markets*

The story presented thus far has taken as given the heterogeneity of investors, the legitimacy of investor demand for assets with particular characteristics (like a AAA rating), the appropriateness of the steps taken by financial intermediaries and others involved in these transactions to feed investor demand, and that those intermediaries were feeding, rather than creating, the investor demand. In so doing, this account has largely assumed that these transactions at least appeared to create value on a localized basis when they were consummated. This Subpart briefly addresses some of the factors which may have con-

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90. A related and well-recognized phenomenon is that in assessing the risks of a financial instrument, investors may be overly influenced by recent events. See HYMAN P. MINSKY, JOHN MAYNARD KEYNES 110 (2008).

91. See Miller & Rosenfeld, *supra* note 24, at 823.

tributed to these transactions spreading even further than could be explained by the gap between their localized and systemic effects. Consistent with the pragmatic aim of this Article to consider what regulators and others reasonably could have known and what actions they may have taken prior to the crisis, the hindsight-enabled insight that many of these transactions did not create real value even on a localized basis<sup>92</sup> is largely delegated to the sidelines for the remainder of this Article. Nonetheless, some of these other forces merit mention in light of the important contributory role they may have played in leading up to the crisis, the fact that many of them may have been visible to regulators, and the possibility that regulators should be mindful of them in assessing the benefits and risks associated with the spread of other financial innovations.

a. *Regulation*

Among the key drivers of financial innovation generally are efforts to reduce the cost of regulatory compliance.<sup>93</sup> Often referred to as “regulatory arbitrage,” such efforts can take a wide array of forms. If a regulation makes it more expensive for financial institutions to hold *X*-type assets than *Y*-type assets, for example, financial institutions will find ways to make *X*s look like *Y*s for purposes of the regulation. Similarly, innovative financial transactions may be used to make it appear that an asset has been transferred from a regulated entity, for which it is costly to hold such an asset, to a nonregulated entity, even when the regulated entity retains an economic interest in the transferred asset.<sup>94</sup>

That regulatory arbitrage contributed to the growth of the MBS and CDO markets is well established.<sup>95</sup> Much of the demand for AAA-rated assets came from investors who faced regulatory or other constraints that required or made it less costly for them to hold such assets.<sup>96</sup> While such transactions may create

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92. See Charles W. Calomiris, *Financial Innovation, Regulation, and Reform*, 29 CATO J. 65, 67 (2009) (“[O]n an ex ante basis, risk was substantially underestimated in the market during the subprime boom of 2003-07.”).

93. See *id.* at 65 (“Financial innovations often respond to regulation by sidestepping regulatory restrictions that would otherwise limit activities in which people wish to engage.”); see also PARTNOY, *supra* note 7, at 46 (“[A] major impulse for financial innovation [i]s a desire to avoid regulation.” (citing Merton H. Miller, *Financial Innovation: The Last Twenty Years and the Next*, 21 J. FIN. & QUANTITATIVE ANALYSIS 459 (1986))).

94. See BRUNNERMEIER ET AL., *supra* note 12, at 67-73 (describing these “boundary problems”). See generally Victor Fleischer, *Regulatory Arbitrage*, 89 TEX. L. REV. 227, 229 (2010) (“Regulatory arbitrage exploits the gap between the economic substance of a transaction and its legal or regulatory treatment, taking advantage of the legal system’s intrinsically limited ability to attach formal labels that track the economics of transactions with sufficient precision.”).

95. See RAJAN, *supra* note 19, at 16; Calomiris, *supra* note 92, at 65.

96. See Acharya et al., *supra* note 8, at 295 (arguing that one of the primary drivers of securitization transactions in the years leading up to the 2007-2009 financial crisis was an attempt by regulated financial entities to reduce the amount of capital they were required to hold under applicable regulations while not making commensurate adjustments in the true



value to the parties involved by allowing them to reduce the regulatory burden to which they would otherwise be subject, such value is often not welfare enhancing. Moreover, regulated entities seeking to circumvent regulations to which they are subject may be willing to pay a premium for the ability to do so, skewing price signals and other market indicators.

b. *Agency costs*

Another key factor contributing to the spread of MBSs and CDOs was agency costs. One source of agency costs arose from tensions between the individuals making investment decisions or overseeing those decisions and the persons whose money they were putting at risk.<sup>97</sup> Notably, the complexity of mortgage securities may have increased these agency costs by limiting the ability of shareholders and others to effectively monitor and identify self-serving behavior.

Another reason that these transactions may have flourished even if they did not create value is that the very complexity of the transactions may have increased the tendency of investors to rely upon the expertise of the financial intermediaries who sponsored the transactions, the agencies that rated them, and the other parties involved in setting up these transactions.<sup>98</sup> Because these parties earned significant fees for the services they provided, they often had a strong incentive to consummate as many transactions as possible, even if somewhat constrained by reputational and other considerations.<sup>99</sup>

While a thorough examination of these dynamics is beyond the scope of this Article, they are noted to make clear that the assumption (employed for the sake of simplicity and to reduce the effect of hindsight bias) that these transac-

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risks to which they were exposed); Richard Cantor et al., *The Use of Credit Ratings in Investment Management in the US and Europe*, J. FIXED INCOME, Fall 2007, at 13, 14, 17 exhibit 1B (noting that in the United States, “there are currently over 100 federal laws and 50 regulations incorporating credit ratings,” and finding that seventy-four percent of the fund managers in their study were subject to ratings-based restrictions on the financial instruments they could hold).

97. Lucian A. Bebchuk & Holger Spamann, *Regulating Bankers’ Pay*, 98 GEO. L.J. 247, 249 (2010); Okamoto, *supra* note 59, at 188; Steven L. Schwarcz, *Conflicts and Financial Collapse: The Problem of Secondary-Management Agency Costs*, 26 YALE J. ON REG. 457, 457-58 (2009).

98. See Lord Adair Turner, Chairman, U.K. Fin. Servs. Auth., The Economist’s Inaugural City Lecture (Jan. 21, 2009) (“[T]here must be a suspicion that some and perhaps much of the structuring and trading activity involved in the complex version of securitised credit, was not required to deliver credit intermediation efficiently, but achieved an economic rent extraction made possible by the opacity of margins and the asymmetry of information and knowledge between end users of financial services and producers.”) (transcript available at [http://www.fsa.gov.uk/library/communication/speeches/2009/0121\\_at.shtml](http://www.fsa.gov.uk/library/communication/speeches/2009/0121_at.shtml)).

99. See John C. Coffee, Jr., *What Went Wrong? A Tragedy in Three Acts*, 6 U. ST. THOMAS L.J. 403, 408-10 (2009).

tions appeared to create value at the time they were consummated likely overstates significantly the value of these transactions.

### III. FRAGMENTATION NODES AND SYSTEMIC RISK

This Part examines two phenomena arising from the proliferation of fragmentation nodes which give rise to systemic risk—information loss and stickiness. It explains why each phenomenon may be expected to arise as fragmentation nodes proliferate, and how each phenomenon may become a source of systemic risk. This Part also provides evidence from the 2007-2009 financial crisis showing that MBS and CDO transactions did contribute to systemic risk through information loss and stickiness, with troubling consequences.

#### A. *Information Loss*

##### 1. *Fragmentation nodes and information loss*

In any securities offering, the issuer selling the securities has more information about the value of the securities offered than the potential investors do.<sup>100</sup> The acts of conveying information (by the seller) and processing information (by the investor) are resource intensive. While a seller must be able to convey sufficient information to a potential investor to convince the investor that the expected returns justify the price being asked, the cost to both parties of this information exchange ensures that the buyer will never know quite as much as the seller. As a result, some information is lost in every transaction.<sup>101</sup> The issue here is not just that information is lost, but that the nature and magnitude of the information loss arising from MBSs and CDOs is sufficiently distinctive to merit particular attention. There are a number of reasons for this.

We can understand the informational challenge by considering the four sources of complexity inherent in fragmentation nodes: (1) fragmentation, (2) the creation of contingent and dynamic economic interests, (3) a latent competitive tendency among the tranches, and (4) the lengthening of the chain separating investor and investment.<sup>102</sup> Because of fragmentation, the number of per-

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100. Bernard S. Black, *Information Asymmetry, the Internet, and Securities Offerings*, 2 J. SMALL & EMERGING BUS. L. 91, 92 (1998) (“[T]he single largest cost that stands between issuers and investors is the problem of asymmetric information.”).

101. *See id.* at 92-93.

102. The account here provides a more thorough analysis of the relationship between the sources of complexity inherent in fragmentation nodes and the resultant information loss, which is critical if we are going to understand how these dynamics might arise again. However, this Article is far from the first to point out that the complexity of these transaction structures contributed to a loss of information. *See, e.g.*, Coffee, *supra* note 99, at 409; Scott & Taylor, *supra* note 88; *The Gods Strike Back: A Special Report on Financial Risk*, ECONOMIST, Feb. 13, 2010, at 2; Jennifer E. Bethel et al., *Legal and Economic Issues in Litigation Arising from the 2007-2008 Credit Crisis*, 26 (John M. Olin Ctr. for Law, Econ. &

sons with an economic interest in a home loan increases dramatically when that loan is placed into a fragmentation node. As a result, each investor has only a very small stake in the performance of any particular loan underlying its investment, and an investor would face a massive informational burden if it actually sought to understand all of the loans underlying its investment. Moreover, as reflected in the dynamic and contingent nature of the economic interests created, each investor's economic stake in any particular loan is not fixed. Rather, an MBS investor's interest in a loan varies depending upon its performance and the performance of the other loans with which it is pooled, so an investor must be concerned with correlation among the performance of the assets.

The second and third sources of complexity further increase the informational burden an MBS investor faces, in that the value of a particular MBS also depends upon the mechanisms built into the waterfall to allocate cash flow rights among the various tranches.<sup>103</sup> The informational burden created by the relevance of these credit-enhancement mechanisms, as well as the pertinence of the degree of correlation in the default risk of the assets in the portfolio, merit particular attention because these are informational burdens that did not exist prior to the creation of the fragmentation node. As a result, the information loss arising from these transactions is not just the byproduct of inevitable information asymmetries, but is also a product of the introduction of new information—information which no party may be adequately incentivized to fully understand. The fourth and final source of complexity—the length of the chain—increases the informational burden on an investor by limiting the investor's ability to observe directly the quality of the assets underlying its investment. This stands in stark contrast to the direct relationship between a bank and a homeowner which would exist in the absence of securitization and which might enable the bank to monitor both the home and borrower more closely.

The informational burden placed on an investor is magnified with the addition of a second or third fragmentation node, such as a CDO or a CDO.<sup>104</sup> When the assets underlying a fragmentation node are themselves structured finance products, each asset requires just as much effort to understand fully as the single MBS just described. The magnitude of the informational burden this places on a potential CDO investor arises both from the compounding of the number of assets which ultimately underlie the investment—recall the number of home loans and other assets underlying the CDOs<sup>2</sup> described by Scott and Taylor<sup>105</sup>—and from the fact that the cash flows coming from each of those as-

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Bus., Discussion Paper No. 612, 2008), available at <http://papers.ssrn.com/abstract=1096582>.

103. Ingo Fender & Janet Mitchell, *The Future of Securitisation: How to Align Incentives?*, BIS Q. REV., Sept. 2009, at 27, 30.

104. See *The Gods Strike Back*, *supra* note 102, at 2 (“A proper understanding of a typical collateralised debt obligation . . . would have required reading 30,000 pages of documentation.”).

105. See *supra* text accompanying note 88.

sets go through two (or more) different fragmentation nodes before reaching the investor. As a result, the relationships among the expected performance of the assets gathered at each node and the terms of the waterfall for each node are layered on top of information about the quality of the thousands (or tens or hundreds of thousands) of home loans ultimately underlying the CDO security issued as information relevant to the value of that security.

On the other side of these massive potential informational burdens lies a very modest return to investors, particularly for the AAA-rated tranches, which constituted the great majority (in terms of principal value) of the MBS and CDO securities issued.<sup>106</sup> At the same time, because MBSs and CDOs are fixed-income securities with finite life spans, the upside potential on these securities is necessarily capped. This distinguishes these securities from other assets like stock, commodities, and real estate, for which the potential gains are not so limited. The limited upside offered by these securities is critical because a potential investor will not expend greater resources collecting and processing information about a security than the excess returns that investor expects to receive from that investment.<sup>107</sup>

To be clear, the claim here does not relate to whether it was possible for investors to obtain sufficient information upon which to make an investment decision in light of these constraints. One may argue that it was irrational for an investor to acquire these securities without a better understanding of the associated risks. Nor does the claim rely on any assumptions regarding the degree to which investors may have relied upon credit ratings or the reasonableness of such reliance. These are not the type of assessment that regulators or other outside observers are in a good position to make. The claim, rather, is that because of the limited amount of resources investors rationally could have expended learning about the MBSs and CDOs prior to making an acquisition decision, and because of the amount of information potentially relevant to the value of those securities, an outside observer could have surmised that most investors were acquiring these securities without a complete understanding of all of the information pertinent to their value. The net result was that, as fragmentation nodes backed by home loans rapidly spread prior to the 2007-2009 financial crisis, there was an equally rapid and systematic loss of information about the quality of the underlying home loans and the value of the various securities backed by them. We now turn to address the consequences of that information

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106. See Yongheng Deng et al., *CDO Market Implosion and the Pricing of Subprime Mortgage-Backed Securities*, 20 J. HOUSING ECON. 68, 70-71 figs.1 & 2 (2011) (showing the average spread between U.S. Treasury bonds and subprime MBSs and the average spread between U.S. Treasury bonds and CDOs backed by subprime MBSs to each be within the range of two to four percent between 2004 and 2006).

107. See Schwarcz, *supra* note 1, at 221 (applying the “rational ignorance theory” to the evaluation of complex securities to explain why “[c]omplexity can deprive investors and other market participants of the understanding needed for markets to operate effectively,” even if all of the information regarding an investment is made available to investors).

loss, namely, that it contributed to inaccurate price signals and greater systemic fragility. Each is addressed in turn.

## 2. *Inaccurate price signals and bubbles*

Financial crises are often preceded by a bubble in which one or more classes of assets are traded at prices far in excess of their fundamental values.<sup>108</sup> While information loss is not a necessary condition for a bubble to form, it may facilitate the growth of a bubble. As Ronald Gilson and Reinier Kraakman explain in their classic article on the mechanisms of market efficiency, the accuracy of price signals depends in part on the presence of informed traders in the relevant marketplace.<sup>109</sup> The lack of sufficiently capitalized informed traders (relative to poorly informed traders) can increase the amount of noise surrounding the price signals created in that market.<sup>110</sup> While the amount of noise need not skew the price signals so long as the direction of the noise is arbitrary, the lack of informed price signals may create an environment in which it is easier for a bubble to develop.

To understand the role of information loss in the events preceding the 2007-2009 financial crisis, it is necessary to recognize that the real estate bubble was in fact two related but distinct bubbles—one in real estate and a second in mortgage securities. The real estate bubble was enabled, at least in part, by the influx of capital into mortgage securities, which increased the amount of capital available for home loans, particularly subprime home loans.<sup>111</sup> Without that influx of capital, and, more specifically, the expectation among mortgage originators that they could quickly and easily resell loans into the secondary market, lending standards most likely would not have declined as far as they did, and real estate prices would not have escalated as high as they did. That capital, however, came in significant part from investors who did not have a clear view through to the quality of the loans underlying their investments.

As we saw in Part II, strong investor demand for AAA-rated assets offering slightly higher yields than other comparably rated investments translated into demand for highly rated subprime MBSs and CDOs. That demand in turn

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108. See POSNER, *supra* note 13, at 10 (“[The] most dangerous type of recession/depression is caused by the bursting of an investment bubble.”); Franklin Allen et al., *Financial Crises: Theory and Evidence*, 1 ANN. REV. FIN. ECON. 97, 98 (2009) (noting that research on financial crises has shown “that systemic banking crises are typically preceded by credit booms and asset price bubbles”).

109. Ronald J. Gilson & Reinier Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549 (1984).

110. See *id.* at 565-92. A distinct but related consideration contributing to these bubbles were limitations on the ability of investors to take short positions on housing prices. See Patricia A. McCoy et al., *Systemic Risk Through Securitization: The Result of Deregulation and Regulatory Failure*, 41 CONN. L. REV. 1327, 1373 (2009).

111. See RAJAN, *supra* note 19, at 16; John C. Coffee, Jr. & Hillary A. Sale, *Redesigning the SEC: Does the Treasury Have a Better Idea?*, 95 VA. L. REV. 707, 731-32 (2009).

created a demand for subprime loans that could be packaged into subprime MBSs, and in turn subprime MBSs that could be packaged into CDOs. Information loss was likely critical to the growth of these interdependent markets. The lower-rated tranches of MBSs are often the most informationally sensitive, so the buyers of these tranches generally have the greatest incentive to scrutinize closely the quality of the underlying home loans.<sup>112</sup> The ability to sell these tranches to CDOs combined with the fact that it was irrational for most CDO investors to examine closely the home loans ultimately underlying those investments (because of the resource-return tradeoff just discussed) suggests that the growth of the CDO and CDO<sup>2</sup> markets and the information losses accompanying that growth may well have contributed to the degradation in underwriting standards and practices and the growth of the subprime market. Those developments, in turn, facilitated real estate speculation, accentuating the tendency of the influx of capital from mortgage securities to drive up real estate prices.<sup>113</sup>

This account, while somewhat speculative, is supported by the data available. For example, the federal panel created to investigate the causes of the 2007-2009 financial crisis, the Federal Crisis Inquiry Commission (FCIC), undertook an “examination of the relative performance of mortgages purchased or guaranteed by the GSEs” and “those securitized in the private market.”<sup>114</sup> Because loans owned or guaranteed by a GSE were not originated by that GSE, they should be similar to loans packaged into private-label MBSs to the extent that issues arise merely from the separation of loan origination and ownership. The FCIC’s findings provide valuable insights into the effects of adding a fragmentation node to the equation, strongly suggesting that the presence of a fragmentation node has a significant and deleterious effect.

The FCIC’s examination reveals that “[t]he worst-performing 5% of [the] loans [held or guaranteed by the GSEs] are in subgroups with rates of serious delinquency similar to the best-performing 5% of [private-label MBS] loans” (i.e., those packaged into a fragmentation node).<sup>115</sup> The subgroups employed by the FCIC enable them to control for other variables, such as the credit score of the borrower and the amount of the loan relative to the value of the home it financed. They further found that, for borrowers with credit scores below 660,

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112. See MacKenzie, *supra* note 68, at 1799-80 (“[T]hose who bought the lowest[rated] externally sold tranches . . . frequently performed their own evaluations of default risk.”); John Kiff & Michael Kisser, *Asset Securitization and Optimal Retention* 27 (Int’l Monetary Fund, Working Paper No. 10/74, 2010) (showing that under certain circumstances, “the screening level under mezzanine retention is actually lower than if the securitizer had retained the equity tranche”).

113. E.g., Andrey D. Pavlov & Susan M. Wachter, Essay, *Systemic Risk and Market Institutions*, 26 YALE J. ON REG. 445, 445 (2009) (arguing that it was “the pro-cyclical expansion of underpriced credit [through private-label MBSs] . . . that drove asset prices up”).

114. FIN. CRISIS INQUIRY COMM’N, *supra* note 69, at 216.

115. *Id.* at 218.

“by the end of 2008, GSE mortgages were far less likely to be seriously delinquent than were non-GSE securitized mortgages: 6.2% versus 28.3%.”<sup>116</sup>

These data and other anecdotal evidence strongly suggest that—while far from the only cause—the loss of information arising from the length and the complexity of the chain separating MBS and CDO investors from the home loans underlying their investments facilitated the growth of both the real estate bubble and the related bubble in mortgage securities.<sup>117</sup> Had a typical CDO investor been able to see plainly the quality of the home loans underlying his investment, he likely would not have been so willing to invest for such a modest return, and less capital would have been available to make low-quality home loans.

To be sure, there are two related issues at stake here. One is the mispricing of the risk associated with home loans, particularly subprime home loans, which was a primary factor in both the real estate and mortgage security bubbles. The other, related issue is the extension of loans that were particularly unlikely to be repaid even on the excessively generous terms on which they were being offered. The claim here is that both may be traced, at least in part, to the information loss that resulted from the proliferation of MBSs and CDOs. The FCIC’s finding that loans packaged into fragmentation nodes performed substantially worse than seemingly similar GSE loans suggests that the presence of a fragmentation node increased the probability of low-quality loans being made.<sup>118</sup> Moreover, as reflected in the timing of the decline in underwriting standards and practices and the growth of the CDO market, there is reason to suspect that as the number of fragmentation nodes along the typical chain increased, so too did the proportion of low-quality underlying assets.<sup>119</sup> The empirical evidence is thus consistent with the conjecture that as the number of fragmentation nodes increased, so too did the rate at which home loans were extended that should not have been. Moreover, because the lowest quality loans should have fetched the lowest prices, this evidence also suggests that the disparity between fundamental values and the prices paid may well have increased with the number of fragmentation nodes separating the ultimate investor from the underlying home loan. The two issues are correlated, and are at least partially attributable to information loss, because of the reduced incentive and ca-

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116. *Id.* at xxvi.

117. *Cf.* Christopher Cox, Former Chairman, SEC, Testimony Before the Fin. Crisis Inquiry Comm’n (May 5, 2010) (transcript available at <http://www.sec.gov/news/testimony/2008/ts102308cc.htm>) (quoting with approval Former SEC Chief Accountant Lynn Turner’s statement that “if honest lending practices had been followed, much of this crisis quite simply would not have occurred”). Further support for this conjecture arises from the fact that it may be rational for investors to vary the amount of information they collect based on their perception of the state of the economy, and investors also will tend to invest little effort in detecting fraud during booms. *See* Paul Povel et al., *Booms, Busts, and Fraud*, 20 REV. FIN. STUDIES 1219, 1220-21 (2007).

118. *See* FIN. CRISIS INQUIRY COMM’N, *supra* note 69, at 216-18.

119. *See supra* Part II.B.2.

capacity of the ultimate investors to conduct due diligence regarding the quality of the underlying assets or to understand the ways that changes in the prices of the underlying assets (or correlations among them) might impact the value of MBSs and CDOs backed by them. In short, while information loss may not be necessary for a bubble to arise, hindsight suggests that it may well have played a role in the bubbles that preceded the 2007-2009 financial crisis, and that the dynamics that occurred may well arise again.

### 3. *Fragility*

In addition to facilitating inaccurate price signals and the growth of bubbles, information loss contributes to systemic risk in other, more direct ways. To understand how, it is necessary to revisit the question of what makes a risk systemic. As Amir Khandani, Andrew Lo, and Robert Merton explain, “[S]ystemic risk . . . arises when large financial losses affect important economic entities that are unprepared for and unable to withstand such losses, causing a cascade of failures and widespread loss of confidence.”<sup>120</sup> Lack of information increases the likelihood of such a scenario in at least three ways.

First, when information is lost, risks may be passed on without the recipient fully appreciating the nature or magnitude of the risk to which he is now exposed. In addition to increasing the likelihood that the price the recipient pays for an asset is not commensurate with its risk, as just described, this uninformed risk assumption increases the likelihood that the recipient will not be positioned to withstand the associated losses should the risk become manifest.

Second, information loss makes market participants more reactive to new information. One well-recognized mechanism through which local financial distress can spread to the banking system generally is “similarity” or “common-mode failure.” This arises when the failure of one financial institution sends signals to the marketplace about the financial well-being of other institutions with similar exposures.<sup>121</sup> If market participants were perfectly informed, of course, a failure would not convey any new information. Lack of information is thus a precondition to the capacity of such an event to convey information, and the greater the amount of information that has been lost, the more informative the signal may be (or may be perceived to be).<sup>122</sup> As a result, as information

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120. Khandani, Lo & Merton, *supra* note 26, at 46.

121. See BRUNNERMEIER ET AL., *supra* note 12, at 3; Jeffrey N. Gordon & Christopher Muller, *Confronting Financial Crisis: Dodd-Frank's Dangers and the Case for a Systemic Emergency Insurance Fund*, 28 YALE J. ON REG. 151, 160 (2011).

122. This account uses the term information very broadly. A more detailed account of the mechanisms through which this updating occurs would require more granular analysis of the interplay between the hard facts known to an investor and the forecasting he necessarily engages in to reach an informed view on the appropriate price of a security. See Gilson & Kraakman, *supra* note 109, at 562 (“[T]he acquisition of a new piece of ‘hard’ information of major importance is likely to affect the trader’s master forecast of price not only directly



loss increases, the financial system becomes more vulnerable to this type of contagion, increasing systemic risk. The contagion can be set off by any ostensibly reliable signal that conveys new information to the market about the value of or risks posed by a particular class of assets or business strategy.<sup>123</sup>

Third, widespread information loss sets the stage for paralyzing uncertainty. When a signal conveys new information suggesting that an investor has dramatically underappreciated the nature or magnitude of a risk to which he is exposed, that revelation introduces the possibility that the investor may also be exposed to other underappreciated risks. Thus, in addition to making adjustments directly responsive to the new information conveyed by the signal, the investor is likely to exercise significantly greater caution in assessing and taking actions in response to other possible risks as well.<sup>124</sup> The result can be widespread panic. Put differently, massive information loss increases the likelihood that bad information will be of the “scary bad” kind, to use a term offered by John Geanakoplos, and thus “instead of clarifying matters” will “increase[] uncertainty and disagreement about the future.”<sup>125</sup>

#### 4. *The unfolding of the 2007-2009 financial crisis*

This Subpart considers evidence from the 2007-2009 financial crisis suggesting that the spread of fragmentation nodes backed by home loans did result in a massive loss of information, and that loss became a source of systemic risk. The descriptive portion of the account that follows draws heavily upon the work of Gary Gorton, who because of his roles as a former consultant to AIG and as an academic economist was particularly well positioned to understand the evolution of the crisis.<sup>126</sup> This account uses an overview of the early phases

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but also indirectly, by altering the information on which much of his ‘soft,’ or forecast information is based.”).

123. See CHARLES P. KINDLEBERGER & ROBERT Z. ALIBER, *MANIAS, PANICS AND CRASHES* 90 (5th ed., 2005) (describing the way “[n]ew information may precipitate a crash”).

124. See Joseph R. Mason, *Regulating for Financial System Development, Financial Institutions Stability, and Financial Innovation*, in *FINANCIAL MARKET REGULATION IN THE WAKE OF FINANCIAL CRISES: THE HISTORICAL EXPERIENCE* 226, 232 (Alfredo Gigliobianco & Gianni Toniolo eds., 2009) (“In an asymmetric information financial crisis, investors—knowing there has been a shock to asset values but not knowing the distribution of that shock among investments—rationally pull back from the market as a whole to decrease their probable exposure.”).

125. Geanakoplos, *supra* note 33, at 104. Notably, Geanakoplos does not address the possibility, claimed here, that characteristics of the environment into which the news is transmitted affects whether it is of the “scary bad” variety.

126. See, e.g., GORTON, *supra* note 31; Gorton, *supra* note 54. Interestingly, while Gorton provides one of the best examinations of the ways information loss contributed to the 2007-2009 financial crisis, he seems to view the information loss arising from the spread of MBSs and CDOs as largely idiosyncratic to that crisis. See GORTON, *supra* note 31, at 146 (stating that in his view the problem does not lie with “securitization generally” but rather lies with “the particular form of the design of subprime mortgages”). By developing a theory

of that crisis to establish the plausibility of the claim, drawing attention to indications that information was lost and that the resultant losses contributed to systemic instability through each of the three mechanisms just identified. For the sake of brevity, many important subsequent developments, including many supportive of this claim, are not addressed.

As described in Part II, the performance of subprime home loans, MBSs backed by subprime loans and CDOs containing, among other things, tranches of subprime MBSs were correlated to each other, and to the housing market. According to Gorton, this “was widely understood,” but “there was a lack of common knowledge about the effects and timing of house price changes.”<sup>127</sup> As a result, early indications that housing values may have been weakening or in decline were not immediately reflected in the prices of subprime MBSs, CDOs, and other financial instruments with linked values, even though the expected future cash flows from these financial instruments could be significantly affected by the performance of the housing market.

The key turning point, according to Gorton, was the introduction of the ABX.HE index. The ABX.HE index, launched in January 2006, tracks the value of credit default swaps referencing a pool of twenty subprime MBSs issued in the preceding six months for each of five credit ratings: AAA, AA, A, BBB, and BBB-. New indices were formed every six months thereafter, until mid-2007. The swaps referencing the index were over-the-counter transactions in which one party agreed to make payments to the other upon the occurrence of enumerated “credit events” in the underlying subprime MBSs.<sup>128</sup> The prices of these swaps were updated on a daily basis. The indices thus provided a standardized and widely available source of current information about the pricing of subprime risk.<sup>129</sup> As other economists have noted, prior to the introduction of the ABX.HE index “there was no real mechanism for aggregating information about the value of subprime mortgages and the securities that they collateralized.”<sup>130</sup>

In early 2007, the ABX.HE index referencing MBSs rated BBB for the first quarter of 2007 began to fall shortly after issuance, and the same index for the second quarter of 2007 started trading substantially below par. Because of the unique visibility of these indices, their rapid decline sent a strong signal to all

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about why information loss may be expected to increase systemic risk as a general matter, this Article goes beyond his analysis of that issue.

127. Gorton, *supra* note 54, at 21-22.

128. Potential credit events “includ[e] interest shortfall, principal shortfall, or a write-down of the underlying subprime MBS.” Dunbar et al., *supra* note 45, at 135.

129. See, e.g., Markit ABX.HE—Product Summary, MARKIT, <http://www.markit.com/en/products/data/indices/structured-finance-indices/abx/abx.page?> (last visited Mar. 9, 2012) (explaining that the indices provide “a liquid, tradeable tool” that enables “investors to accurately gauge [sic] market sentiment around the asset-class, and to take short or long positions accordingly”).

130. Dunbar et al., *supra* note 45, at 134; see also Gorton, *supra* note 54, at 20.

market participants that financial instruments exposed to subprime risk were worth substantially less than the prices at which they had been trading. The effects of this signal were threefold and followed the mechanisms set forth above: the holders of subprime MBSs, CDOs, and other financial instruments with subprime MBS exposure faced losses for which they had not adequately prepared; some of those entities faced financial distress, sending further signals to the marketplace; and concern about the possibility of underappreciated risks in other assets led to a wave of uncertainty, sending at least some market participants into a panic-like state and severely disrupting the functioning of a number of markets.

When the ABX.HE index started its decline, structured investment vehicles (SIVs), asset-backed commercial paper conduits, and other similar entities funded in whole or in part by short-term asset-backed commercial paper were among the parties holding MBSs and CDOs.<sup>131</sup> These managed entities made money by funding such longer-term assets with shorter-term liabilities (like commercial paper) and were central features of the shadow banking system.<sup>132</sup> The precipitous fall in the ABX.HE indices was followed by a “run” on these SIVs, as investors in the short-term asset-backed commercial paper funding the SIVs refused to roll over those investments as they matured.<sup>133</sup>

The actual risk exposures of these SIVs, established with the benefit of hindsight, cannot justify investor response.<sup>134</sup> That is, the cause of this run was not the actual credit risk to which these entities were exposed, but rather uncertainty about the magnitude of that risk, prompted by the informational signal sent by the rapid decline in the ABX.HE index and by the fact that investors had only a limited understanding of the actual risks to which the SIVs (and hence the commercial paper that they issued) were exposed.<sup>135</sup> As Federal Reserve Chairman Ben Bernanke explained in a speech a few months later:

[T]he developments in subprime were perhaps more a trigger than a fundamental cause of the financial turmoil. The episode led investors to become more uncertain about valuations of a range of complex or opaque structured credit products, not just those backed by subprime mortgages. They also

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131. *See, e.g.*, Money Market Fund Reform, Investment Company Act Release No. 28,807, 74 Fed. Reg. 32,688, 32,691 (proposed July 8, 2009) (to be codified at 17 C.F.R. pts. 270, 274) (providing a summary of these developments); Acharya et al., *supra* note 8, at 281; Gorton, *supra* note 54, at 24.

132. *See, e.g.*, Gerding, *supra* note 4, at 14-15.

133. Acharya et al., *supra* note 8, at 283 (explaining that during this collapse of the market for asset-backed commercial paper, the cost of issuing such paper “rose from just 15 basis points over the Federal Funds rate to over 100 basis points,” effectively requiring the SIV sponsors to bail them out).

134. *See* Gorton, *supra* note 54, at 24.

135. This reaction may have been particularly swift because many of the investors in those entities were money market funds, which may be particularly quick to divest themselves of assets with uncertain risk exposures. *See, e.g.*, Money Market Fund Reform, 74 Fed. Reg. at 32,691.

reacted to market developments by increasing their assessment of the risks associated with a number of assets and, to some degree, by reducing their willingness to take on risk more generally.<sup>136</sup>

To be sure, Bernanke underestimated the magnitude of the problems to come when he made these statements, but that does not undermine his assessment of the processes through which investors responded to these developments.

Following the run on SIVs, the market for repurchase agreements (or “repos”), which are essentially fully secured short-term loans, contracted dramatically.<sup>137</sup> The repo market is built upon the assumption that repos, because they are short term, fully collateralized, and entitled to certain preferences in the event of bankruptcy, are very low-risk investments. The assets that had been used as collateral for repos included not only the subprime MBSs and CDOs described thus far, but a variety of other complex structured financial products as well. Just as had happened in the run on SIVs, the uncertainty surrounding the value of subprime MBSs and CDOs made it difficult for those seeking financing through repo agreements to use any of these assets as collateral on terms commensurate with those they had been able to obtain prior to the SIV run.<sup>138</sup> Put differently, the rapidly declining prices of subprime MBSs and CDOs forced investors to recognize how little they knew about the fundamental value of other similarly complex financial instruments. This development led them to question whether other assets about which they had a similar amount (or lack) of information might also be worth far less than they had thought. As a result, individual participants in the marketplace became more risk averse in unison, which had adverse systemic consequences.<sup>139</sup> Because many financial institutions, particularly investment banks, had come to rely upon repo financing to fund their trading and other operations, the evaporation of the repo market adversely affected the ability of financial institutions to continue to serve as market makers for other financial products, causing the markets for virtually all types of financial instruments to contract.<sup>140</sup>

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136. Ben S. Bernanke, Chairman, Fed. Reserve, Address on the Recent Financial Turmoil and its Economic and Policy Consequences (Oct. 15, 2007).

137. *The Gods Strike Back*, *supra* note 102, at 8 (“As confidence ebbed, mortgage-backed securities could no longer be used so easily as collateral in . . . ‘repo’ agreements.”); Gorton, *supra* note 54, at 26 (describing how there was a run on repo).

138. See Acharya et al., *supra* note 8, at 303 (discussing the “abrupt shifts in the market price of risk when the crisis took hold in August 2007” and suggesting they came about because up until that time investors did not have a good understanding of the risks to which financial institutions and entities they sponsored were exposed). One of the primary effects of this uncertainty was that repo traders demanded a greater haircut with respect to these types of assets, which had the effect of limiting the amount of short-term financing an entity could obtain using such assets as collateral.

139. See BRUNNERMEIER ET AL., *supra* note 12, at 23 (“When liquidity dries up, it disappears altogether rather than being re-allocated elsewhere . . . . Thus, there is a generalized decline in the willingness to lend.”).

140. See Markus K. Brunnermeier, *Deciphering the Liquidity and Credit Crunch 2007-2008*, J. ECON. PERSP., Winter 2009, at 77, 80; *The Gods Strike Back*, *supra* note 102, at 8.

Among the financial institutions most seriously affected by these dramatic changes in the repo market was investment bank Bear Stearns, which also was suffering from insufficiently anticipated losses as a result of its sizeable portfolio of subprime and other MBSs and CDOs.<sup>141</sup> The combination resulted in a fire sale of Bear Stearns to JP Morgan Chase, which, even at the fire-sale price of the transaction, was viable only because of significant financial support from the federal government.<sup>142</sup> This event in turn sent a signal to the market that other firms with large MBS and CDO portfolios might also be facing severe financial distress.<sup>143</sup> While it was not until months later that Lehman Brothers filed for bankruptcy and the financial crisis reached its peak, the groundwork for those failures was laid, and the mechanisms leading to those failures followed many of the same patterns just described.<sup>144</sup> The subprime crisis thus became a full-blown financial crisis, and the loss of information arising from the complexity of the MBS and CDO transactions that had spread subprime risk played a crucial role in this development.

As this account reflects, numerous factors operating together contributed to the financial crisis. Without investment banks' excessive reliance on repos and other modes of short-term financing, for example, the reverberations of the systematic loss of information about the value of the assets underlying MBSs and CDOs would likely not have been as severe. At the same time, without information loss, investment banks' reliance on short-term financing might not have been so problematic, and the magnitude of the 2007-2009 financial crisis might have been much smaller. As will be discussed further in Part IV, we can begin to see why information loss arising from complexity may be among the sources of systemic risk that regulators should target. But any such efforts should supplement, rather than supplant, other efforts to reduce systemic risk.

### B. *Stickiness*

This Subpart examines a second source of systemic risk arising from the complexity associated with the spread of MBSs and CDOs—stickiness. Stickiness here refers to the creation, within a dynamic financial market, of arrangements which are exceptionally difficult to modify. This Subpart considers how packaging home loans into fragmentation nodes increased their stickiness and how such stickiness can become a source of systemic risk. In so doing, it

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141. Ian Boardman, Note, *The Collapse and Rescue of Bear Stearns*, 28 REV. BANKING & FIN. L. 42, 43-45 (2008).

142. *See id.* at 45-46.

143. *See* Gordon & Muller, *supra* note 121, at 160.

144. *See, e.g.,* Allen et al., *supra* note 108, at 99 (stating that the “more disruptive consequence” of the Lehman bankruptcy “was the signal it sent” as “[r]eassessing risks previously overlooked, investors withdrew from the markets and liquidity dried up”).

builds upon and adds to a growing body of literature looking at these dynamics.<sup>145</sup>

### 1. *Fragmentation nodes and stickiness*

One effect of the complex structure of fragmentation nodes is the capacity of these transactions to function like an adhesive, holding in place the original terms of the underlying assets. As described in Part II, the creation of multi-tranche structures in which the rights of each tranche are set by reference to the original terms of the underlying assets creates a latent competitive tendency among the different tranches. Because any modification in the terms of an underlying asset affects different tranches in a disparate manner, this competitive tendency becomes manifest when circumstances arise that warrant such modification. In the context of an MBS, this means that any modification to the terms of an underlying home loan will affect each tranche differently depending upon whether the interest rate, principal, or some other term is modified.

As the complexity of the MBS structure increases, so too does the range of issues that can arise from modifications. This is reflected, for example, in the various types of triggers that may be used to determine whether principal should be distributed sequentially, and thus paid out only to the most senior tranche still outstanding, or pro rata among all of the tranches. If such a trigger is set by reference to the proportion of underlying loans that are delinquent at a particular point in time, the process of renegotiating a significant number of those underlying loans to avoid delinquency and default raises questions about whether corresponding changes should be made to the terms of that trigger.

Given that the types of loan modifications at issue are expected to increase the aggregate cash flows into the securitization vehicle, one may expect that the holders of the different tranches could work together to ensure the modifications are made, agreeing to corresponding changes in the terms of each of the tranches of the MBS as needed. There are, however, numerous coordination challenges that must be overcome for this to happen, as the terms of the MBS once issued may be changed only with the consent of all holders.<sup>146</sup> Thus, in addition to the latent competitive tendency among the tranches becoming manifest, each of the other sources of complexity inherent in fragmentation nodes further contributes to the stickiness of the original terms of the underlying home loans.

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145. *E.g.*, Anna Gelpern & Adam J. Levitin, *Rewriting Frankenstein Contracts: Workout Prohibitions in Residential Mortgage-Backed Securities*, 82 S. CAL. L. REV. 1075 (2009); Zachary J. Gubler, *The Financial Innovation Process: Theory and Application*, 36 DEL. J. CORP. L. 55, 75 (2011); Hu & Black, *supra* note 7, at 687; Adam J. Levitin & Tara Twomey, *Mortgage Servicing*, 28 YALE J. ON REG. 1, 58 (2011); Christopher Mayer et al., *Essay, A New Proposal for Loan Modifications*, 26 YALE J. ON REG. 417, 418 (2009); Schwarcz, *Protecting Financial Markets*, *supra* note 10, at 393.

146. *See* Gelpern & Levitin, *supra* note 145, at 1091-92.

The sheer number of persons with an interest in an underlying loan—a problem arising directly from the fragmentation of economic interests in that loan—creates a host of coordination challenges.<sup>147</sup> Contacting each of the investors, much less negotiating with and obtaining approvals from all of them, is a highly resource-intensive endeavor. And if undertaken by anyone other than the trustee (such as an MBS investor seeking to maximize the value of his investment in the face of changed circumstances), the task is made even more challenging by the initial hurdle of trying to obtain the identities of all of the investors holding MBSs issued in that transaction. Moreover, because of the dynamic and contingent economic interests held by each tranche, the holder of even the first-loss tranche may have a colorable claim that its interests were not adequately protected depending upon the changes made. This creates a situation ripe for holdouts, as well as genuine claims by holders of one or more tranches that a particular modification inappropriately favors other tranches. The magnitude of these coordination issues increases with both the number of different tranches and the complexity of the specific bundle of rights granted to investors in each tranche.

Further adding to the coordination challenge is the final source of complexity identified in Part II, the lengthening of the chain separating investor and investment, as one or more of tranches of the MBSs issued were often packaged into serial fragmentation nodes like CDOs. This raises a preliminary issue of trying to determine who, on behalf of the CDO, may approve changes in the terms of MBSs. Moreover, virtually all of the coordination challenges that arise at the MBS level also arise at the level of the CDO. As a result, the packaging of tranches of an MBS into a serial fragmentation node is likely not just to increase, but to compound in a dramatic, nonlinear fashion the stickiness problems just described.

The same web of coordination challenges will inhibit changes to any other agreements to which the securitization vehicle is a party, such as the servicing agreement setting forth the duties and obligations of the servicer retained to handle administrative matters associated with holding a home loan. They also complicate substantially the task of any agent, like the servicer, charged with maximizing the value of the underlying assets.<sup>148</sup> The net result is a coordination nightmare, which, as we will see, has had real and adverse systemic consequences.

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147. Cf. Michael Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621, 688 (1998) (describing the way “[t]ransaction costs, holdouts, and rent-seeking may prevent” efficient solutions when too many persons hold an exclusion right with respect to a piece of property).

148. Steven L. Schwarcz, *Keynote Address: The Conflicted Trustee Dilemma*, 54 N.Y.L. SCH. L. REV. 707, 708-14 (2010).

## 2. *Stickiness in the financial crisis*

A core component of the 2007-2009 financial crisis was the first nationwide fall in residential housing prices since the Great Depression. These falling home prices contributed to a dramatic rise in the rate of defaults on home loans.<sup>149</sup> This Subpart shows how the stickiness just described inhibited and otherwise adversely affected modifications to those home loans, and the next Subpart shows how those effects became a source of systemic risk.

As noted in Part II, one key to making MBS structures work was the appointment of a servicer charged with collecting monthly payments from homeowners, distributing those proceeds to the securitization vehicle, and dealing with other issues that may arise in connection with “servicing” the underlying home loans.<sup>150</sup> The obligations of a servicer to a private-label MBS securitization are set forth in a pooling and servicing agreement. When delinquency and default rates are low, the process of servicing a home loan is largely ministerial. Foreclosures create some complications, but because the need for a servicer to have the authority to oversee a foreclosure process was apparent at the outset, servicing agreements contain detailed procedures for the servicer to follow. The ability to address these situations *ex ante* through contract eliminated the need to vest the servicer with much discretion, an arrangement that suited MBS investors and servicers alike.<sup>151</sup>

While foreclosure procedures may have been clear, foreclosure is not the only option available to the holder of a home loan when a homeowner defaults. Modifying the terms of that loan is another, and one that may be particularly appropriate if circumstances have changed substantially since the loan was originated. While servicing agreements allow for modifications under certain circumstances, in the face of the skyrocketing default rates witnessed in the 2007-2009 financial crisis, the nature and scope of the authority granted to servicers to deal with nonperforming loans was revealed to be inadequately defined, and, in many regards, just inadequate. One recent study of servicing agreements found that the terms of servicing agreements in private-label MBSs, while varying significantly, were alike in providing servicers insufficient guidance on how to handle loan modifications and insufficient monetary incentives to pursue modification.<sup>152</sup> Moreover, even when servicers had discretion to modify

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149. See OFFICE OF THE COMPTROLLER OF THE CURRENCY & OFFICE OF THRIFT SUPERVISION, OCC AND OTS MORTGAGE METRICS REPORT: DISCLOSURE OF NATIONAL BANK AND FEDERAL THRIFT MORTGAGE LOAN DATA: FOURTH QUARTER 2009, at 14 (2010) (describing the increase in the proportion of mortgages that were seriously delinquent in 2009).

150. This discussion focuses solely on private-label MBSs.

151. See 1 FRANKEL, *supra* note 39, § 5.4, at 179.

152. See Larry Cordell et al., *The Incentives of Mortgage Servicers: Myths and Realities* 4, 17 (Divs. of Research & Statistics & Monetary Affairs, Fed. Reserve Bd., Fin. & Econ. Discussion Ser. No. 2008-46, 2008); see also Mayer et al., *supra* note 145, at 423 (“Most [servicing agreements] do not explicitly limit modifications, but instead contain vague language that can paralyze servicers.”).



loans, they were not given sufficient incentives to do so in ways that would maximize the value of the loan.<sup>153</sup> These deficiencies may be attributed to how infrequently home loans were modified prior to the financial crisis or to an expectation that limiting the ability of a servicer to modify a home loan will, in general, increase the expected return on that home loan.<sup>154</sup>

The effects of this stickiness, however, vary depending upon the circumstances in which it becomes manifest. When home values are stable or rising, and the amount owed on a home loan is less than the value of the home securing it (as a result of a down payment, equity built up over the life of the loan, or rising home values), foreclosure enables the holder of the loan to recover most, if not the full amount, of the loan outstanding at the time of default. The recovery rate falls significantly, however, when housing values are depressed. As a result, when home prices started to fall at the beginning of the financial crisis, foreclosure often ceased to be the best way to maximize the value of loans in default, and modification became more important.<sup>155</sup>

Data regarding the rate of foreclosures and loan modifications during the financial crisis reveal that servicers acting on behalf of MBSs have not been as responsive to these developments as banks acting on their own behalf. One study of seriously delinquent loans originated in or after 2005 revealed that the securitization of a loan significantly increases the likelihood that the loan will be foreclosed, rather than modified.<sup>156</sup> A subsequent study “us[ing] direct and precise data on renegotiation actions of lenders” found that “distressed securitized loans are significantly less likely to be renegotiated (up to 36% in relative terms) than similar bank-held loans.”<sup>157</sup> These results make clear that securiti-

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153. See Levitin & Twomey, *supra* note 145, at 29 (“It makes little sense [for servicers] to maintain a large coterie of experienced loss mitigation personnel . . . . The lack of attention paid to loss mitigation, particularly during the bubble years, meant that there was limited loss mitigation capacity in the servicing system as mortgage defaults started to rise in 2006-2007.”). Levitin and Twomey provide a thoughtful and thorough analysis of the principal-agent tension between MBS investors and servicers and the reasons the contractual arrangements in place failed to mitigate this tension. See *id.* at 69-84.

154. See Andrew Haughwout et al., *Second Chances: Subprime Mortgage Modification and Re-Default 2* (Fed. Reserve Bank of N.Y., Staff Report No. 417, 2009), available at <http://ssrn.com/abstract=1527870> (“Modification of existing mortgages has historically been quite unusual . . . .”). This stickiness may have appeared efficient ex ante by discouraging strategic defaults. Tomasz Piskorski et al., *Securitization and Distressed Loan Renegotiation: Evidence from the Subprime Mortgage Crisis*, 97 J. FIN. ECON. 369, 394 (2010); see Gelpern & Levitin, *supra* note 145, at 1102.

155. A separate obstacle to loan modifications is the existence of a second lien on the same underlying home. Mayer et al., *supra* note 145, at 419.

156. Piskorski et al., *supra* note 154, at 371 (“Conditional on a loan becoming seriously delinquent, we find that the foreclosure rate of bank-held loan [sic] is lower as compared to securitized loans by around 3% to 7% in absolute terms (13% to 32% in relative terms).”).

157. Sumit Agarwal et al., *The Role of Securitization in Mortgage Renegotiation*, 102 J. FIN. ECON. 559, 560 (2011). Another study has found otherwise, but Piskorski et al. question the robustness of those findings and the more precise methodology employed by Agarwal and his co-authors resolves the debate. Compare Manuel Adelino et al., *Why Don't Lenders*

zation creates a bias toward foreclosure, and they strongly suggest that securitization has hindered even efficient modifications.<sup>158</sup>

The evidence further suggests that even when loans are modified, loans held by a bank are more likely to be modified in an efficient manner than a loan that has been securitized. The same study that looked at the renegotiation actions of lenders found that “conditional on modification, portfolio-held loans receive smaller concessions . . . . Yet, their post-modification performance is stronger.”<sup>159</sup> It thus “appears that servicers renegotiate their own loans more efficiently than they do loans owned by outside investors.”<sup>160</sup>

Data compiled by federal regulators further suggest that even when a loan is modified, the ways in which the terms of a loan are altered vary dramatically depending upon whether it has been packaged into a fragmentation node. Data for the fourth quarter of 2009 show that a homeowner who was granted a modification had a 27.7% chance of receiving a principal reduction if his loan was retained by the originating bank, but only a 0.02% chance of such a reduction if his loan instead was placed into a private-label MBS.<sup>161</sup> In other words, in a large sample of loans, roughly half of which were retained by the originating bank and half of which were packaged into private-label MBSs, 99.9% of the modifications involving a reduction in principal occurred in home loans retained by the originating bank.<sup>162</sup> This matters for the long-term performance of the modified loans because the likelihood that a borrower will redefault on a

*Renegotiate More Home Mortgages? Redefaults, Self-Cures and Securitization* 3, 4-5 (Nat’l Bureau of Econ. Research, Working Paper No. 15,159, 2009), available at <http://www.nber.org/papers/w15159> (finding low levels of loan renegotiations but no meaningful differences in the effect of securitization on loan renegotiation rate between loans that had been securitized and those that had not), with Piskorski et al., *supra* note 154, at 393-94 (describing limitations in the methodology used by Adelino et al.), and Agarwal et al., *supra*, at 559-61 (describing the debate and explaining why their study resolves in favor of the position that securitization does impact loan modification rates).

158. See Piskorski et al., *supra* note 154, at 394-95 (recognizing that market participants may not have anticipated the dramatic downturn in the housing market, so “government initiatives facilitating renegotiation of securitized loans could benefit both borrowers and investors”).

159. Agarwal et al., *supra* note 157, at 575.

160. *Id.*

161. OFFICE OF THE COMPTROLLER OF THE CURRENCY & OFFICE OF THRIFT SUPERVISION, *supra* note 149, at 27 tbl.23. Of the 59,723 home loans modified during that period that were either retained by the originating bank or packaged into a private-label MBS, 8431 included a principal reduction, and all but five of those were retained by the bank rather than securitized. See *id.* at 27 tbl.22.

162. Fifty-one percent of the loans in the relevant sample—30,459 out of 59,723—were retained as part of a bank’s portfolio. See *id.* at 27 tbl.22; see also Geanakoplos, *supra* note 33, at 120 (“Another indication that servicers have bad incentives is that when the big banks hold the same kind of loans in their private portfolios, they do reduce principal.”); Gretchen Morgenson, *Why Treasury Needs a Plan B for Mortgages*, N.Y. TIMES, Dec. 6, 2009, at B1 (“Studying second-quarter government data . . . , [Laurie] Goodman found that when banks owned the loans, 30.5 percent of modifications reduced principal balances. When they service someone else’s loan . . . , they rarely allow principal reductions.”).

home loan is lower when the modification takes the form of a reduction in principal.<sup>163</sup> And, because banks that hold a home loan have a direct financial stake in maximizing its value, these data provide further evidence that loans packaged into a private-label MBS are granted principal reductions far less often than would be efficient.

The different rate of loan modification and the different types of modifications made may be attributed to the stickiness that arises from the packaging of a home loan into a fragmentation node. As a preliminary matter, the packaging of home loans into a fragmentation node necessitates the use of an agent to service those loans. The complexity inherent in fragmentation nodes then contributes to stickiness by creating competing interests among different classes of investors and giving rise to an array of other coordination challenges. Those sources of stickiness make it difficult, if not impossible, to modify the servicing agreement or to put into place any alternative mechanism enabling MBS investors to authorize modifications in the underlying loans. They further contribute to excess foreclosures by incentivizing a servicer to interpret narrowly the scope of its discretionary authority in order to avoid the risk of one tranche claiming that the servicer acted inappropriately. As explained in one study of servicer behavior, concern “about legal liability from dissatisfied investors, especially in cases where a modification benefits some MBS tranches at the expense of others,” was cited by some servicers as a reason for not pursuing loan modification more frequently.<sup>164</sup>

The relative reluctance of servicers who do pursue loan modifications to agree to a reduction in principal may also be attributable to a concern about the disparate impact on different tranches. A reduction in the interest rate on a loan generally leads to an incremental reduction in the cash flows coming into the securitization vehicle over the remaining life of that loan. Because of the contingent and dynamic interests of each of the tranches, it may not be immediately clear which tranches would be most affected and how adversely. A principal reduction, by contrast, is generally recorded immediately and deducted fully from the most junior tranche outstanding.<sup>165</sup> This increases the likelihood of holders of that tranche crying foul.<sup>166</sup> Reluctance to alter particular terms of a loan is a more mild form of stickiness than reluctance to modify at all, but it is still a form of stickiness and it arises from the same underlying causes.

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163. See Haughwout et al., *supra* note 154, at 25-27; see also Morgenson, *supra* note 162.

164. Cordell et al., *supra* note 152, at 4, 22-23.

165. See Geanakoplos, *supra* note 33, at 119.

166. See Schwarcz, *Protecting Financial Markets*, *supra* note 10, at 393 (noting that one reason “[s]ervicers . . . may . . . prefer foreclosure over restructuring” is that restructuring presents a greater litigation risk, which “is exacerbated by the fact that, in many MBS, CDO, and ABS CDO transactions, cash flows deriving from principal and interest are separately allocated to different investor tranches”); see also Geanakoplos, *supra* note 33, at 119.

To be clear, the claim here is not just about litigation risk. Legal reforms were adopted to try to protect servicers from liability,<sup>167</sup> and, while hard to sever from other changes made around the same time, the reforms did not appear to have any substantial positive effect on the modification rate.<sup>168</sup> Nor does the claim deny that other factors, like second liens and insufficient servicer incentives, may also contribute to stickiness. Nonetheless, concern about unfair treatment of particular tranches may well still have been a significant factor in servicer recalcitrance. One of the core challenges highlighted here is that different tranches will be affected in disparate ways depending upon how a loan is modified. At the same time, because of the heterogeneity of fragmentation nodes, no single formula can be devised in the abstract and then applied across the board. As a result, for any third party—be it the mortgage servicer or even a federal regulator—to step in and substantially reduce the principal amount owed on a loan or otherwise modify its terms without making a corresponding change to the terms of the fragmentation nodes virtually ensures that some tranches will be disproportionately harmed while others receive effective wind-falls. This risk appropriately will make both servicers and federal regulators more hesitant to intervene, even if they are lawfully empowered to do so.

This framing is important in part because it helps to explain why even the government's attempts to shield servicers from liability have done little to increase the rate of loan modifications, particularly principal writedowns. Just as importantly, perhaps, it shows that the same dynamics that preclude private market participants from modifying home loans may also inhibit effective government intervention. It could thus help to explain why the government's attempts to forestall defaults and foreclosures have been so ineffective in light of the magnitude of the problem, despite strong political support to address foreclosures and falling home values.

While the challenges associated with the appointment of a servicer may be viewed in significant part as a principal-agent problem, this tension was far greater than it would have been had the principal been a single entity or even numerous entities with perfectly aligned interests. The net effect was to make the original terms of the home loans packaged into fragmentation nodes far more sticky than they would otherwise have been. While both the specific mechanisms (the involvement of servicers) and the result (excess foreclosures) are important, the core of these problems lies deeper, in the very structure of fragmentation nodes and the use of serial fragmentation nodes.

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167. *See, e.g.*, Helping Families Save Their Homes Act of 2009, Pub. L. No. 111-22, § 201, 123 Stat. 1632, 1638-40 (codified as amended at 15 U.S.C. § 1639a (2006 & Supp. IV 2010)) (providing a servicer safe harbor for mortgage loan modifications).

168. *See* Geanakoplos, *supra* note 33, at 120 (noting that the new law did not lead to a rise in loan modifications reducing principal).

### 3. *Stickiness and systemic risk*

That the packaging of a home loan into a fragmentation node increases the likelihood that the loan will be foreclosed may seem unfortunate for the homeowners affected but not an issue of systemic significance. Had the packaging of home loans into fragmentation nodes remained rare, this characterization may have been accurate. However, once it became the norm for home loans to be securitized, the systemic effects of these excess foreclosures (and hence of the stickiness giving rise to them) changed dramatically.

As Anna Gelpern and Adam Levitin have explained, “[W]hen . . . rigid contracts [like home loans packaged into fragmentation nodes] are ubiquitous, they can function as social suicide pacts, compelling enforcement despite significant externalities.”<sup>169</sup> Henry Hu and Bernard Black have also recognized the potential for this type of stickiness to become a source of systemic risk. According to Hu and Black, once securitization becomes widespread for a class of assets, such as home loans, this stickiness can lead to “gridlock—defaults which could have been avoided if loans could have been renegotiated, and a macro-level collapse in housing prices, which then drives up default risk for all lenders.”<sup>170</sup>

In other words, the stickiness arising from securitization contributed, perhaps significantly, to the falling home prices and the record rate of defaults witnessed over the course of the crisis. This is because foreclosures cause home values to fall further than they otherwise would, so a feedback loop forms. As the last Subpart showed, stickiness results in more foreclosures than there would have been had the home loans not been securitized.<sup>171</sup> Those excess foreclosures depress home values further.<sup>172</sup> Because the performance of home loans generally, and subprime loans in particular, is closely linked to home values, this negative externality exacerbates the underlying problems—additional homeowners are now unable to refinance, some of those homeowners default, and some of those defaults which would best be addressed through a loan modification are instead foreclosed. The loop then repeats itself.

The magnitude of the role played by this stickiness is difficult to gauge, but a study by Amir Khandani, Andrew Lo, and Robert Merton on the effects of cash-out refinancings by homeowners suggests that the effect of a feedback

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169. Gelpern & Levitin, *supra* note 145, at 1075; *see also* Piskorski et al., *supra* note 154, at 395.

170. Hu & Black, *supra* note 7, at 691.

171. *See* Gelpern & Levitin, *supra* note 145, at 1125 (“[W]here most home loans are securitized under restrictive [servicing agreements], one would expect more foreclosures in an economic downturn.”); *see also supra* Part III.B.2.

172. Geanakoplos, *supra* note 33, at 107 (“Auction sales of foreclosed houses usually bring 30 percent less than comparable houses sold by their owners. . . . [B]y going into foreclosure, a borrower lowers housing prices and makes it more likely that his neighbor will do the same.”); Gelpern & Levitin, *supra* note 145, at 1125; Mayer et al., *supra* note 145, at 417.

loop in this area may be quite significant. The authors use a model to show that the increased leverage in a typical home loan arising from cash-out refinancing dramatically increased the fall in real estate values over the course of the crisis. They identify as the reason “a destructive feedback loop of correlated foreclosures, forced sales, and ultimately, a market crash.”<sup>173</sup> Because of the similarity of the destructive feedback loop they identify, which they identify explicitly as a source of systemic risk, and the feedback loop arising from the stickiness here at issue, there is reason to suspect that the identified stickiness may have played a significant contributory role in the dramatic decline in home values.<sup>174</sup>

The ongoing foreclosure crisis, depressed home values, and the persistently high incidence of bank closures—many of which have been accredited to losses on real estate and construction loans, the value of which may also have fallen as a result of the stickiness described here—further suggest that stickiness may have been an important contributor to systemic risk.<sup>175</sup> The connection between this stickiness and those phenomena is necessarily speculative and—because of massive federal intervention to overcome this stickiness and other challenges to home-loan modifications—may remain so.<sup>176</sup> Nonetheless, the evidence available supports the notion that the original terms of a home loan become sticky when the loan is placed into a fragmentation node, and terms that make the competitive tendency among the tranches particularly salient, such as the principal value of the loan, become particularly sticky. Moreover, because of the compounding of the coordination challenges that arise when one or more tranches of an MBS are packaged into a serial fragmentation node, the terms of the underlying loans become correspondingly stickier when a serial fragmentation node is added. As it became the norm for home loans to be packaged into fragmentation nodes, those sources of stickiness became a source of systemic risk. That risk became manifest when housing prices started to fall, leading to excess foreclosures, which in turn fed a feedback loop of falling home values, more excess foreclosures, and greater losses for financial institutions and others holding mortgage securities or otherwise exposed to home values. This illustrates the way that pervasive stickiness may, as a general matter, contribute to a feedback loop through which even a small adverse change can be amplified significantly, leading to systemic effects that the parties creating the sticky arrangements are not adequately incentivized to consider or avoid.

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173. Khandani, Lo & Merton, *supra* note 26, at 3.

174. Foreclosures also contribute to other negative externalities, including adverse effects on the communities in which the foreclosed homes sit. See Gelpert & Levitin, *supra* note 145, at 1125; Mayer et al., *supra* note 145, at 417.

175. See Sara Murray, *Falling Home Prices Reveal Limits of Recovery*, WALL ST. J., Jan. 26, 2011, at A2 (“Home prices have buckled under excess housing supply, exacerbated by foreclosures.”).

176. See, e.g., Phillip Swagel, *The Financial Crisis: An Inside View*, BROOKINGS PAPERS ON ECON. ACTIVITY, Spring 2009, at 1, 10-22, (providing a summary of the myriad programs pursued by various federal agencies to address rising foreclosures in 2007 and 2008).

## IV. POLICY IMPLICATIONS

This Part addresses the policy implications of the case study. The sources of systemic risk identified here—information loss and stickiness arising from complexity—bear little resemblance to the sources of systemic risk that regulators have targeted traditionally. As we saw in Part I, however, systemic risk regulation is a renewed priority of policymakers for good reason, and there is a recognized need for new types of oversight, particularly macroprudential regulations aimed at maintaining the stability of the financial system as a whole. This Part suggests that regulations targeting complexity arising from the spread of financial innovations should be among the tools that regulators use in that endeavor.

A. *Looking Back*

Before examining what regulators could have done to address these sources of systemic risk or what they should yet do, it is important to acknowledge that these issues will almost assuredly not arise again in this context. There are numerous reasons for this. First and foremost is that market participants, once burned, will be twice shy before again buying complex mortgage securities. In light of the amount of attention MBSs and CDOs received in the 2007-2009 financial crisis and the taint that attention has cast on them, even market participants who believe that MBSs and CDOs may be good investments will proceed with greater caution before acting on those beliefs. Moreover, various legal reforms specifically designed to address issues raised by the spread of MBSs and CDOs, including efforts to improve the quality of home loans, have been or are in the process of being put into place.<sup>177</sup> The collective effect of such reforms, combined with the greater caution of market participants, virtually ensures that these particular securities will not again proliferate in ways giving rise to widespread information loss and stickiness. This Article, accordingly, makes no effort to propose specific reforms to address the issues raised.

This Article also refrains from making any firm claims about the types of policies regulators should have adopted prior to the financial crisis to address these sources of systemic risk. The complexity here at issue came bundled with an array of other effects, both positive and negative. Consistent with the aim of this Article to function as a study in financial innovation, complexity, and systemic risk, no effort has been made to catalogue all of the other costs and benefits of securitization. Nor has this Article addressed how the benefits and costs

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177. *See, e.g.*, 12 U.S.C. §§ 1701, 5301 (2006 & Supp. IV 2010); 15 U.S.C. §§ 77d, 77g, 78c, 78o, 78o-7, 78o-11, 1601-02, 1638-39, 1639c, 1639e, 1639h, 1640; 17 C.F.R. pts. 229, 232, 240, 249 (2011); Prohibition Against Conflicts of Interest in Certain Securitizations, 76 Fed. Reg. 60,320 (proposed Sept. 19, 2011) (to be codified at 17 C.F.R. pt. 230) (proposing rule implementing section 621 of the Dodd-Frank Wall Street Reform and Consumer Protection Act).

of regulations directly targeting the sources of systemic risk highlighted here compare and interact with other tools for reducing systemic risk. In Part I we saw that many of the reforms adopted to reduce systemic risk thus far may have the effect of encouraging innovations like securitization. This strongly suggests that efforts to reduce systemic risk arising from the spread of such innovations may be important complements to reforms targeting financial institutions. Nonetheless, it is beyond the scope of this Article to compare more directly the benefits and costs of interventions targeting these sources of systemic risk relative to other efforts to maintain the stability of the financial system.

The preceding analysis, however, does provide a foundation from which we can draw inferences about the efficacy of different modes of regulation. By examining the benefits and costs of different regulatory responses that could have been adopted prior to the recent financial crisis to address information loss and stickiness, this Part sheds light on how effective different types of regulations are likely to be in reducing the sources of systemic risk at issue. In so doing, it sheds light on the types of tools that may be helpful to regulators as they seek to address systemic risk arising from the spread of other financial innovations.

## B. *Looking Ahead*

### 1. *Disclosure*

Disclosure is one of the most commonly used tools in financial regulation and has been identified as potentially valuable in alleviating both of the sources of systemic risk identified here.<sup>178</sup> Better disclosure, by its nature, should reduce information loss, and increased transparency could reduce the magnitude of the coordination challenges that lead to stickiness. The preceding analysis, however, makes clear that disclosure alone will not suffice.

Recall that CDOs were distributed almost exclusively to large, sophisticated investors generally capable (or at least presumed to be capable under applicable securities laws) of identifying, obtaining, and processing the information required to evaluate a potential investment. The rapid rate at which these transactions proliferated suggests that investors believed they had obtained sufficient information about the securities to make an investment decision. Yet, as the discussion of information loss in Part III makes clear, the amount of information most of these investors obtained and processed was far from complete. These statements are not inherently consistent. Because of the costs to investors of obtaining and processing information, it may be rational for an investor to make an investment with far less than perfect information. The challenge for policymakers is that the level of resources that an investor seeking to maximize

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178. See, e.g., Hu & Black, *supra* note 7, at 693; Scott & Taylor, *supra* note 88.



its own returns will invest in gathering information may well be less than is socially optimal. Accordingly, disclosure reforms can reduce but will not eliminate this mismatch.

A recent study by Robert Bartlett supports the conjecture that mandating greater disclosure would not have prevented this source of systemic risk. Bartlett shows that a major hedge fund with demonstrated analytic capability and a strong financial incentive (in the form of a significant short position with respect to an insurance company with significant MBS and CDO exposure) nonetheless failed to utilize available information about the specific MBSs underlying CDO transactions insured by the company in analyzing the company's exposure and expected losses on the insurance policies.<sup>179</sup> Based upon that failure and the contrast between the market's reaction to downgrades in CDOs the company insured and downgrades in corporate debt the company insured, Bartlett concludes that his results "are strongly suggestive that enhancing derivative disclosures, by itself, is unlikely to reduce the uncertainty that often plagues analysis of a firm's exposure to complex credit derivatives such as CDOs."<sup>180</sup> Similarly, better disclosure might reduce, but will not eliminate, the myriad coordination challenges that give rise to stickiness. While disclosure might lower the costs of identifying the other holders, for example, it cannot eliminate the conflicts that arise from situations that cause the latent competitive tendencies among the tranches to become manifest.

This is not an argument against disclosure. Without disclosure, these problems would likely be substantially worse. Nonetheless, this analysis does suggest an inherent limit on the efficacy of disclosure to address these sources of systemic risk. This case study, accordingly, provides support for the position, already endorsed by others, that there are significant limitations on the capacity of disclosure to address the risks associated with complex financial innovations.<sup>181</sup>

## 2. Chain length

The clear inadequacy of disclosure raises the question of what other tools regulators might use to address the sources of systemic risk here at issue. Having shown that these risks arose from specific sources of complexity inherent in fragmentation nodes, one response could be to seek ways to reduce those sources of complexity. While the potential benefits of such regulations are clear, so too are the potential pitfalls. Steven Schwarcz, for example, has warned against this type of direct intervention. As he explains, "Complexity is

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179. See Robert P. Bartlett, III, *Inefficiencies in the Information Thicket: A Case Study of Derivative Disclosures During the Financial Crisis* 36 J. Corp. L. 1 (2010).

180. *Id.* at 7.

181. See, e.g., Steven L. Schwarcz, *Rethinking the Disclosure Paradigm in a World of Complexity*, 2004 U. ILL. L. REV. 1, 16-17; Brunnermeier & Oehmke, *supra* note 82, at 2 (discussing investor information overload); Turner, *supra* note 98.

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. The harm averted by [proscribing transactions] would, therefore, likely exceed its benefits.”<sup>182</sup> This concern, while appropriate, does not provide a sufficient basis for completely avoiding regulations targeting particular modes of financial innovation.

As a preliminary matter, virtually all regulations have costs. Costs are reasons to avoid a mode of regulation only if they exceed the expected benefits or if there are less costly ways to achieve the desired result. Neither condition can be assumed in this context. Moreover, as discussed in Part I with respect to capital adequacy requirements, even traditional approaches to systemic risk regulation often involve limiting activities known to create value when times are good in order to promote the stability of the financial system when the good times end.

Put differently, the fact that a transaction creates value on a localized basis does not mean that the transaction should not be regulated, as it may be socially optimal to prevent such transactions. In order for any transaction to be efficient on net, it must not only create value, but the value created must exceed the costs associated with the transaction, including increased systemic risk. It is precisely because the parties to a transaction will never be adequately incentivized to avoid systemic risk that regulation is required. As illustrated by the sources of systemic risk at issue here, many sources of systemic risk are the byproduct of activities which, viewed in isolation, create value. It is for this reason that Henry Hu has emphasized that regulators have a particular duty to be mindful of, and responsive to, the systemic effects of financial innovation.<sup>183</sup> When the systemic effects associated with the spread of a particular innovation include increased systemic risk, interventions that preclude otherwise beneficial transactions may be justified.

The question thus becomes: how might regulators reduce the highlighted sources of complexity while not overly restricting financial innovation and net beneficial transactions? There were numerous developments in the evolution of MBS and CDO transactions described in Part II that increased their complexity and the complexity of the capital markets in ways that contributed to both information loss and stickiness. Most of those developments, however, added only incrementally to these phenomena. Increasing the number and variety of tranches, for example, increased the informational burden on potential investors and the potential coordination challenges, but the additional information loss and stickiness that resulted were roughly proportional to the incremental development. Trying to create rules to limit such developments would be a difficult

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182. Schwarcz, *supra* note 1, at 239 (footnote omitted).

183. *See* Hu, *supra* note 7, at 1502-03.

task, likely requiring some relatively arbitrary line-drawing.<sup>184</sup> This Subpart suggests that regulators should instead seek to intervene at points where there is a nonlinear increase in the sources of complexity at issue with no corresponding jump in the potential value created. Because the addition of a fragmentation node between the investor and the asset ultimately underlying its investment is precisely such a development, regulators could have sought ways to reduce the number of fragmentation nodes along that chain. Two examples illustrate this approach.

a. *Discourage serial fragmentation nodes*

The packaging of financial instruments that have already gone through one fragmentation node into a second fragmentation node magnifies the resultant information loss and stickiness. By increasing exponentially the number of underlying assets, using assets that themselves are complex financial instruments, and using more complex structures, a CDO investor faces a far greater information burden than an MBS investor. This results in significantly greater information loss. Moreover, because CDOs often acquired the most informationally sensitive tranches of MBSs issued, the rise of CDOs played a critical role in the systematic loss of information about the quality of the underlying home loans and the value of securities backed by them. Similarly, while the packaging of a home loan into an MBS gives rise to stickiness as a result of coordination and other challenges, those issues are magnified when one or more tranches of that MBS is packaged into a CDO. Restricting serial fragmentation nodes would thus have gone a long way toward reducing the information loss and stickiness arising from these transactions.

To be sure, restricting serial fragmentation nodes may have precluded some beneficial transactions. Nonetheless, the potential benefits of serial nodes are far less evident than the benefits arising from the creation of the initial fragmentation node, a fact that was apparent well before the crisis hit.<sup>185</sup> This not only makes it likely that the benefits of regulations targeting serial fragmentation nodes are likely to exceed the costs, but also suggests that the costs of a regulatory error are likely to be relatively small.

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184. Another policy option not discussed here is for regulators to work with market participants to encourage standardization. Particularly in light of the degree to which heterogeneity increased the informational burden on investors and reduced the options available ex post to address the coordination issues that arose, facilitating standardization could be another important role for regulators to play. *See, e.g.*, NOURIEL ROUBINI & STEPHEN MIHM, *CRISIS ECONOMICS: A CRASH COURSE IN THE FUTURE OF FINANCE* 193-94 (2010) (advocating standardization). Notably, however, others have argued that standardization can actually result in increased systemic risk. *See, e.g.*, Charles K. Whitehead, *Destructive Coordination*, 96 CORNELL L. REV. 323, 327 (2011).

185. As described in Part II, the primary benefits of securitization, such as enabling the separation of origination and ownership and pooling to provide diversification, are accomplished with a single node.

It is also critical to recognize that regulators could have targeted serial fragmentation nodes without banning such transactions outright. Regulators could have, for example, made an upward adjustment on the risk-adjusted capital charge imposed on banks and other regulated entities for assets that have passed through serial fragmentation nodes.<sup>186</sup> Alternatively, regulators could have imposed a transaction tax solely on transactions constituting a serial fragmentation node. These types of interventions do not require regulators to second-guess the value arising from a transaction; they merely create a higher threshold that must be satisfied, in terms of localized value creation, to offset the potential for the transaction to contribute to systemic risk.<sup>187</sup>

b. *Encourage simplifying alternatives*

For the same reasons that it may have been appropriate for regulators to discourage serial fragmentation nodes, regulators could have attempted to reduce the number of fragmentation nodes separating investor and investment by encouraging financial innovations that shorten, and thereby simplify, the chain separating these two ends. Had U.S. regulators looked abroad for such alternatives to MBSs and CDOs, they would have found a prime candidate—the covered bond. Covered bonds were used frequently in Europe prior to the financial crisis and have proven far more resilient than private-label MBSs.<sup>188</sup>

Covered bonds are similar to MBSs in that they are backed by a pool of assets, such as home loans. They are different, however, in that they remain direct obligations of the financial intermediary that issues them, and that intermediary must replace the underlying assets if they fail to perform. As a result, as economist Hyun Song Shin has explained, in contrast to an MBS the “pool serves mainly as credit enhancement and not as a means to obtain exposure to the underlying assets.”<sup>189</sup> The net effect of using covered bonds is thus a “shortening of the intermediation chain” separating investor and investment.<sup>190</sup>

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186. The viability of such interventions is supported by the fact that regulations in the nature of those proposed have been adopted in response to the 2007-2009 financial crisis. See BASEL COMM. ON BANKING SUPERVISION, ENHANCEMENTS TO THE BASEL II FRAMEWORK 1, 30 (2009) (adding the concept of “resecuritisation exposures” and imposing higher risk weights for such assets than for other securitized assets).

187. Cf. Fin. Economists Roundtable, *Reforming the OTC Derivatives Markets*, J. APPLIED CORP. FIN., Summer 2010, at 40, 43 (2010) (proposing regulatory changes to the derivatives market that would effectively heighten the minimum “marginal benefit of new products” while not forbidding further innovation, on the basis that the overall scheme proposed would reduce systemic risk).

188. See *From Prussia with Love: The Covered Bond*, ECONOMIST, Sept. 13, 2008, at 80, 80 (noting that “covered bonds have grown into a \$3 trillion asset class, dominated by issuers in Europe,” and describing certain advantages of these securities over MBSs).

189. Hyun Song Shin, *Financial Intermediation and the Post-Crisis Financial System* 14 (Bank for Int’l Settlements, Working Paper No. 304, 2010).

190. *Id.* at 13, 15.

The use of covered bonds could substantially mitigate both information loss and stickiness.<sup>191</sup> Because the financial intermediary issuing the covered bonds remains directly liable, it has an incentive to understand the expected value and risks inherent in each of the underlying home loans. It also has the incentive and ability to modify the loan in the face of dramatically changed circumstances. Moreover, like efforts to discourage serial fragmentation nodes, this type of intervention could have been implemented in a variety of ways. In light of the frequency with which covered bonds are used in other countries and the demand by U.S. investors for covered bonds, removing regulatory constraints on the use of covered bonds and putting regulations into place to facilitate their issuance might have been sufficient to spur banks to issue covered bonds.<sup>192</sup> Regulators also could have pursued more aggressive policies, such as incentivizing regulated entities to acquire covered bonds, without mandating the issuance of covered bonds.

c. *Market forces*

It is important to note that the proposed interventions facilitate, as well as impede, market forces. This is possible because of the many types of market forces at work in the capital markets. Some of those forces, including those we have relied upon to produce an efficient and stable financial system, involve market participants making varying assessments of the expected future cash flows from a financial instrument, then buying, selling, and engaging in other activity based upon their assessments. The failure of these market forces played a central role in the 2007-2009 financial crisis and can have significant costs even apart from circumstances giving rise to a financial crisis.<sup>193</sup>

As we saw in Part II, the market forces driving the spread of fragmentation nodes backed by home loans were very different in nature. Those market forces arose primarily from investor demand for financial instruments with particular characteristics, such as a AAA rating and a relatively high rate of interest. The preceding account also showed how the latter type of market forces (those aris-

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191. There are also policy considerations apart from the reduction of these sources of systemic risk for regulators to encourage the use of covered bonds in lieu of MBSs. *See, e.g.*, Steven L. Schwarcz, *The Conundrum of Covered Bonds*, 66 BUS. LAW. 561, 573-86 (2011); Shin, *supra* note 189, at 13-15.

192. *See* Covered Bond Policy Statement, 73 Fed. Reg. 21,949, 21,950 (Apr. 23, 2008) (explaining that insured deposit institutions have expressed an interest in issuing covered bonds and have sought guidance from the FDIC regarding applicable regulations); Prabha Natarajan, *Covered Bonds from Canada Set Record*, WALL ST. J., July 16, 2010, at C6; Shin, *supra* note 189, at 14-15.

193. Joseph E. Stiglitz, Keynote Address at the Eighth BIS Annual Conference: Interpreting the Causes of the Great Recession of 2008 (June 25-26, 2009), in FINANCIAL SYSTEM AND MACROECONOMIC RESILIENCE: REVISITED 4, 9-10 (Monetary & Econ. Dep't, Bank for Int'l Settlements, BIS Papers No. 53, 2010), available at <http://www.bis.org/publ/bppdf/bispap53.pdf>.

ing from investor demands for financial instruments with particular characteristics) can impede the efficient operation of the former type of market forces (those focused on the fundamental value of the projects underlying the financial instruments).<sup>194</sup> Accordingly, the proposed regulatory interventions could be characterized as efforts to restrain certain market forces which have the potential to increase systemic risk, so that other market forces, which are more likely to promote the efficiency and stability of the financial system, may play a relatively greater role in shaping the capital markets.<sup>195</sup>

The possibility that reducing the number of fragmentation nodes separating investor and investment may promote market efficiency is critical to understanding why such reforms may be warranted even with other reforms that might address information loss or stickiness. One might, for example, argue that reforms to reduce information loss are unnecessary in light of policy reforms intended to improve the accuracy of credit ratings. It is true that the loss of information about the quality of the underlying loans and various securities backed by them would have been far less problematic had the ratings given to MBSs and CDOs been more accurate.<sup>196</sup> Nonetheless, the process of assessing the probability that a security will default is one that necessarily requires making numerous judgment calls about which reasonable minds can differ.<sup>197</sup> A capital market system in which one entity makes an informed decision about the likelihood of default—and hence, the value of a debt instrument—and other investors blindly accept the accuracy of that assessment is not the model of the capital markets we have relied upon to produce a stable and efficient system for the allocation of capital. Moreover, as we saw in the theoretical account of the reasons that information loss may increase the fragility of the financial system, investors acting in reliance on others' assessments rather than on the basis of

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194. See Andrei Shleifer & Robert W. Vishny, *Unstable Banking*, 97 J. FIN. ECON. 306, 306-07 (2010) (showing that steps taken by financial intermediaries to cater to shifting investor sentiment can increase the instability of the financial system).

195. See Lawrence G. Baxter, *Internationalisation of Law—The “Complex” Case of Bank Regulation*, in *THE INTERNATIONALISATION OF LAW: LEGISLATING, DECISION-MAKING, PRACTICE AND EDUCATION* 3, 23 (Mary Hiscock & William van Caenegem eds., 2010) (“The principal consideration in attempting to reshape a dangerously unstable complex system such as international banking [is how to] encourage[] more spontaneous self-ordering.”).

196. One challenge may be that the investors who were acquiring the AAA-rated MBSs and CDOs prior to the 2007-2009 financial crisis were doing so based on the assumption that the securities were “information insensitive,” and thus those investors would not do any due diligence regardless. While perhaps accurate as a descriptive matter for some of the investors, as we saw above, the demand was not just for AAA-rated assets, but AAA-rated assets providing a higher rate of return than other similarly rated assets, like U.S. Treasury bonds. Despite the possible shortage of truly information-insensitive securities relative to the demand, it should come as little surprise to sophisticated investors that securities offering a higher rate of return have some credit risk and should be assessed accordingly.

197. See Gilson & Kraakman, *supra* note 109, at 560-62 (explaining that “two different types of information bear[] on asset price: the ‘hard’ information of known facts, and the ‘soft’ information of forecasts and estimates,” so even a person aware of every relevant hard fact “would lack a type of information critical to price determination”).

actual information are likely to react quickly and dramatically if a signal comes to light suggesting financial instruments they own are riskier than they had realized.<sup>198</sup> In such an environment, even an erroneous signal could cause widespread panic and deleterious market disruptions. To be clear, the claim here is not that rating-agency reform is not warranted. As stated at the outset, the account of the crisis provided here and the policy responses proposed are intended to complement rather than compete with other accounts. The rating agencies clearly failed in the task assigned to them in the years leading up to the crisis, and their failures certainly contributed to the crisis, so rating-agency reform is clearly warranted. Rather, the claim here is that such reforms, even if successful, will not obviate the importance of structural reforms of the type proposed in this Article.

Similarly, one could argue that market participants and regulators, appreciative of how problematic stickiness can be, can now devise tools narrowly designed to address the issue. Securitization transactions backed by other asset types, for example, at times give agents greater authority and incentives to modify the terms of the underlying assets.<sup>199</sup> Similar schemes could, in theory, be imported into MBSs and CDOs. The challenge presented by stickiness, however, is not the narrow question of whether we can modify home loans packaged into fragmentation nodes. The challenge is that each time a debt instrument is created, that instrument cannot feasibly address in detail how the rights of the parties should be altered for every possible state of the world that might arise over the life of the instrument. As a result, there will necessarily be situations governed by standards ill-suited to address a particular set of circumstances, and other situations left completely unaddressed. The insufficient discretion and incentives given to servicers to modify home loans in the face of dramatic declines in the price of real estate is merely illustrative of the types of gaps that are unavoidable when a loan is transformed from a bilateral relationship between a bank and a homeowner into an asset traded in the capital markets. There is no simple or abstract solution to this challenge.

This Article has introduced the notion of a fragmentation node, and proposed tools that could be used to reduce the number of nodes separating investor and investment, because such structural reforms have the potential to reduce both of these challenges irrespective of what the future holds. The longer and more complex the chain separating investor and investment, the more difficult it will be for investors to engage in due diligence and make an informed, independent assessment of the value of the security he is acquiring. Likewise, the length and complexity of the chain tend to increase the stickiness of each of its components, inhibiting even efficient changes in their terms should circumstances arise that were not adequately addressed at the time the underlying financial instruments and other components were created. When a particular fi-

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198. *See supra* Part III.A.2.

199. *See, e.g.,* Gelpern & Levitin, *supra* note 145, at 1103.

nancial innovation spreads and becomes pervasive, these tendencies can increase the fragility of the overall system. As we saw in the discussion of the reasons for regulating systemic risk in Part I, these are the types of developments that no market participant will be adequately incentivized to identify and address. While the number of fragmentation nodes separating investor and investment is a rough proxy for the effects here at issue, it is at least a viable one. Accordingly, identifying and targeting new innovative financial structures that change the landscape of the capital markets in ways akin to the changes wrought by fragmentation nodes may be an important component of policy efforts to reduce systemic risk. The next Subpart addresses other counterarguments to this claim.

### C. *Some Challenges*

#### 1. *Recurrence*

A core challenge in any case study is determining how broadly its findings apply. Even if one accepts the role played by information loss and stickiness in the 2007-2009 financial crisis and the potential utility of intervention, that new understanding means little if the issues were unique to that crisis. But in fact, the same issues are likely to recur.

Despite the dampening effect the 2007-2009 financial crisis has had on the rate of financial innovation, there are reasons to expect ongoing innovation in the years ahead. As a preliminary matter, recent history is replete with disasters perceived to be so great that they made major reforms slowing financial innovation seem inevitable, but that never in fact triggered significant changes. For example, Enron's bankruptcy in 2001 following its abuse of structured-finance transactions—a field of finance that includes securitization—led many to believe that market participants and regulators would be more skeptical of structured finance and more discerning in their evaluation of complex transactions. Similarly, the nearly cataclysmic collapse of the hedge fund Long-Term Capital Management in 1998 led many to expect that financial institutions would adopt more effective risk-management regimes and be more cautious about the potential risks, particularly systemic risks, to which they might be exposed. The dramatic rise in securitization transactions and other developments leading up to the recent financial crisis belied these expectations.

In addition, the recently adopted Dodd-Frank Act and other legal responses to the financial crisis will likely operate as an impetus for further financial innovation. The desire to reduce the cost of regulatory compliance (i.e., regulatory arbitrage) is one of the key drivers of financial innovation generally.<sup>200</sup> Moreover, as discussed in Part I, many of the specific reforms adopted impose

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200. See Calomiris, *supra* note 92, at 65-66; see also PARTNOY, *supra* note 7, at 48.



new costs on banks and other financial institutions, increasing the potential economic gains from innovations that enable funding activities traditionally performed by banks to be moved into the capital markets. Securitization is precisely such an innovation. Accordingly, once economic conditions revive, we can expect to see a rise in financial innovations like securitization and the shadow banking system of which it is a part.

Another consideration, reflected in the descriptive account in Part II, is the intense pressure on banks and other financial institutions to develop and exploit new financial innovations. As Henry Hu has explained, “To stay competitive, banks constantly introduce new financial products because margins on products decline quickly.”<sup>201</sup> Neither the financial crisis nor the responses to it have reduced those competitive pressures. Other academic experts have also taken the view that despite the financial crisis, financial innovation will continue, if not accelerate, in the coming years.<sup>202</sup> Thus, although the specific events examined above are unlikely to arise again, the overall trend of financial innovation is likely to continue, and an appropriately framed case study may provide valuable insights into some of the challenges and opportunities such developments create for regulators seeking to limit systemic risk.<sup>203</sup>

The question thus becomes whether financial innovations are likely to give rise to the types of issues revealed in this case study. Again, there are reasons to expect this is possible if not probable. The most obvious way these issues could again arise would be in the context of fragmentation nodes backed by assets other than home loans. A wide array of asset classes, including auto loans, aircraft leases, computer leases, credit card receivables, franchise loans, health-care receivables, health club receivables, music royalties, tax liens, taxi medalion loans, and viatical settlements have been packaged into fragmentation nodes. Such transactions ground to a halt during the 2007-2009 financial crisis, but the market has started to revive.<sup>204</sup> Some commentators have even suggested that the failure of MBSs and CDOs could lead to greater investor demand for the types of asset-backed securities that performed relatively well during the financial crisis.<sup>205</sup> At the same time, in light of the market and legal

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201. Hu, *supra* note 7, at 1479 (footnote omitted); *see also* Charles W. Calomiris, *The Subprime Turmoil: What's Old, What's New, and What's Next*, J. STRUCTURED FIN., Spring 2009, at 6, 43 (“The structure of U.S. financial intermediation will probably undergo significant changes over the next few years . . . [as t]he American financial system, if it remains true to its history, will adapt and innovate its way back to profitability and high stock prices . . .”).

202. *E.g.*, Andrew W. Lo & Robert C. Merton, *Preface to the Annual Review of Financial Economics*, 1 ANN. REV. FIN. ECON. 1, 12 (2009) (“[T]he implementation of financial innovation is likely to be more rapid because the threshold for change is lower.”).

203. The issue of how broadly the dynamics revealed in this study may be applied is addressed in Part IV.A.

204. *See, e.g.*, GORTON, *supra* note 31, at 22 tbl.2.1 (identifying types of assets that have been securitized).

205. *E.g.*, Calomiris, *supra* note 201, at 41-42.

responses to securitization in the wake of the crisis, it is possible that fragmentation nodes will not again give rise to the sources of systemic risk at issue.

Even outside the realm of securitization, however, complexity arising from the spread of new financial innovations may well result in information loss and stickiness. Many financial innovations, particularly those that could be used to shift financing activities from regulated banks into the capital markets, involve the parsing and repackaging of various rights and risks. As a result, many if not all of the sources of complexity identified as inherent in fragmentation nodes—fragmentation, creation of contingent and dynamic economic interests, a latent competitive tendency among the different classes of investors, and the lengthening of the chain separating investor and investment—are likely also to be present in new financial innovation. And, for the reasons we saw in Part III, such innovations are likely to give rise to both massive informational burdens that make information loss likely and coordination challenges causing effects like stickiness.

New financial innovations may also give rise to new sources of complexity unlike those produced by fragmentation nodes, which could also give rise to effects like information loss and stickiness. While the exact ways in which innovations may create complexity and impede information flows are difficult to foresee, that innovation and the complexity resulting from it will lead to information losses seems probable, if not certain.

To be sure, information loss and stickiness do not always give rise to systemic risk. The account of how information loss and stickiness arising from MBS and CDO transactions contributed to the 2007-2009 financial crisis rested upon the fact that these transactions had become pervasive, taking on systemic dimensions in the years leading up to the crisis. Had these transactions remained rare, information loss and stickiness would not have contributed to systemic risk in the ways detailed above. As the case study also made clear, however, when an innovation appears to create value on a localized basis, financial intermediaries have a strong financial incentive to exploit that opportunity, and to be creative in doing so, making it likely that such innovations will evolve and proliferate. Accordingly, the small likelihood of recurrence of a mortgage-security bubble is no reason for regulators to ignore the more general sources of systemic risk at issue here.

## 2. *Identification*

Another challenge could be that it is simply impractical to ask regulators to identify these sources of systemic risk before they become manifest. While this case study may enable regulators to identify and respond to the complexity arising from the spread of MBSs and CDOs, the dangers of those instruments have already been made plain by the crisis. If complexity from the proliferation of a new financial innovation arises, it will look too different for regulators to readily recognize its capacity to contribute to information loss and stickiness. It is

the complexity that regulators do not see, much less understand, that is most likely to be problematic.

Such concerns are merited. The most pernicious forms of complexity may well be disguised in sheep's clothing. As we saw in the story of MBSs and CDOs, for example, the Gaussian copula and other similar devices played a key role by providing market participants and regulators a plausible basis for believing that the complexity arising from fragmentation nodes could be managed even without being understood directly. Similar stories are likely to accompany, and perhaps disguise, the complexity of future financial innovations. A related challenge, also illustrated in the case study, is that both the complexity of individual instruments and the complexity in the market arising from their proliferation develop incrementally. The incremental nature of these processes may result in market participants and regulators alike becoming overly accepting of innovations already used with apparent success, further adding to the regulatory challenge. While there are no easy answers to these issues, they are not a reason to avoid this type of regulation.

As a starting point, the analysis in Part II suggested some responses to these challenges. First, regulators and others concerned about systemic risk can seek ways to evaluate innovations with fresh eyes. Such perspective shifting might have led, for example, to greater questioning of the efficacy of the mechanisms used to minimize the moral hazard inherent in the originate-to-distribute mode of banking as the market for mortgage securities grew and evolved. Second, regulators can seek ways to take a step back and consider the systemic consequences of the evolution and proliferation of particular modes of financial innovation, mindful of the possibility that the aggregate effects of those developments may be qualitatively different from the effects of any individual transaction. The introduction of the term "fragmentation node," along with identification of other types of "nodes" that may be found along the chain separating investor and underlying asset, may facilitate such perspective shifting. In short, while it may not be easy for regulators to identify these types of systemic risk in a timely fashion, the fact that they are not self-evident is a reason for—not against—regulatory scrutiny.

### 3. *Response*

A closely related counterargument is that even if regulators do identify a potential issue, determining when and how to intervene is too challenging a task for regulators to undertake, particularly considering the possibility of error. Like the challenge of identifying problematic financial innovations, however, these concerns justify regulatory caution but not abdication.

Determining when to intervene, for example, does pose a real challenge. The accounts of systemic risk provided in Part III each hinged upon the pervasiveness of fragmentation nodes backed by home loans. If regulators delay intervention until a particular innovation is sufficiently pervasive to be a signifi-

cant source of systemic risk, however, it may be far more difficult to intervene productively. Ultimately, determining when to intervene may depend upon the mode of intervention and the nature of the risk. Mild interventions, such as regulatory or other legal changes to facilitate a more favorable mode of financial innovation (like covered bonds), or efforts to work with market participants to encourage standardization, may be appropriate before there is any indication of trouble. Regulatory interventions that place a clear thumb on the scale, such as adjustments in capital adequacy requirements, may merit a slightly higher threshold. Proscriptions and other more draconian interventions should be used sparingly and only when regulators have an adequate understanding of the benefits and risks of the financial innovation in question.

As with efforts to identify problematic sources of complexity, particular indicia may aid regulators in this task. The fact that a financial innovation facilitates regulatory arbitrage may, for example, be a sign that regulators should act sooner rather than later. This is both because to the extent regulatory arbitrage drives a transaction, there is less reason to assume that it creates any real value, even on a localized basis, and also because regulated entities share a common incentive to find ways around costly regulations, making an innovation that enables such arbitrage likely to spread.

It may also be appropriate for different regulators, or the same regulator taking action with respect to different types of regulated entities, to act at different times. As reflected in the current regulatory scheme, different regulated entities may pose very different risks and thus are appropriately subject to very different types of regulations. Money market funds, for example, are subject to far more stringent limitations on the assets they can hold than most other regulated entities. There are a variety of reasons for this: money market funds' fear of "breaking the buck," constraints on the efficacy of market checks, and the critical role the funds play in the provision of short-term financing.<sup>206</sup> It may accordingly be appropriate for the SEC, which has oversight authority over money market funds, to be particularly aggressive in ensuring that the funds do not acquire assets with risks they cannot easily assess. Such an approach would have the advantage of allowing various regulatory bodies to learn from one another before instituting their own rules.

As a general matter, the policy proposals set forth above provide a framework for the type of interventions likely to be effective. The process of translating these ideas into practice will need to be responsive to a number of context-specific considerations. This need for customization limits the extent of useful guidance that can be provided in the abstract, but it is not a reason to avoid this type of regulation altogether.

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206. See Money Market Fund Reform, Investment Company Act Release No. 28,807, 74 Fed. Reg. 32,688, 32,689-90 (proposed July 8, 2009) (to be codified at 17 C.F.R. pts. 270, 274).

## CONCLUSION

While the next financial crisis will inevitably look different from the one that just passed, how different it is and how many years pass before it strikes depend in part on how effectively we learn the lessons of the recent crisis. This Article adds to the growing body of work seeking to ensure that the next financial crisis does not arise prematurely. By exploring the interplay of financial innovation, complexity, and systemic risk, this Article has shed light on the ways the complexity arising from the spread of financial innovations may contribute to systemic risk and on the tools that may be most effective in addressing those sources of systemic risk.

