

# Law & Finance Events



UNIVERSITY OF  
OXFORD

## Leverhulme Lectures 2010

5.30-6.30pm, Gulbenkian Lecture Theatre,  
Faculty of Law, St. Cross Road, Oxford OX1 3UL

**Tuesday, 9 November:**

### The Global Financial Crisis and Systemic Risk

**Wednesday, 10 November:**

### Regulating Complexity in Financial Markets

**Thursday, 11 November:**

### The Future of Securitisation

**Professor Steven L. Schwarcz,**  
Stanley A. Star Professor of Law and Business,  
Duke University; Leverhulme Visiting Professor  
of Law, Oxford University (Michaelmas 2010).



**LEVERHULME LECTURE**  
**REGULATING COMPLEXITY IN FINANCIAL**  
**MARKETS<sup>1</sup>**

10 November 2010, Oxford University

**Steven L. Schwarcz**

Stanley A. Star Professor of Law & Business

Duke University

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*Complexity is the greatest challenge to 21<sup>st</sup> Century financial regulation, having the potential to impair markets and investments in several interrelated ways. Furthermore, complexity can cause failures that individual market participants cannot, or will not have incentive to, remedy. These failures are driven by information uncertainty, misalignment of interests and incentives among market participants, and nonlinear feedback and tight coupling that result in sudden unexpected market changes. These are the same types of failures that engineers have long faced when working with complex engineering systems. The lecture uses engineering solutions such as chaos theory to examine how financial regulation should be structured to correct those failures.*

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<sup>1</sup> © 2010 by Steven L. Schwarcz. This lecture is based in part on the following works: *Regulating Complexity in Financial Markets*, 87 WASH. U. L. REV. 211 (2009/2010), available at [http://ssrn.com/abstract\\_id=1240863](http://ssrn.com/abstract_id=1240863); *Regulating Systemic Risk* (with Prof. Iman Anabtawi), forthcoming 86 NOTRE DAME L. REV., issue no. 4 (Spring 2011), available at <http://ssrn.com/abstract=1670017>; *Disclosure's Failure in the Subprime Mortgage Crisis*, 2008 UTAH. L. REV. 1109, available at [http://ssrn.com/abstract\\_id=1113034](http://ssrn.com/abstract_id=1113034); *Rethinking the Disclosure Paradigm in a World of Complexity*, 2004 U. ILLINOIS L. REV. 1 (2004), available at <http://ssrn.com/abstract=336685>; and *Information Asymmetry and Information Failure: Disclosure Problems in Complex Financial Markets*, in CORPORATE GOVERNANCE AND THE GLOBAL FINANCIAL CRISIS: INTERNATIONAL PERSPECTIVES (William Sun, Jim Stewart, & David Pollard, eds.) (forthcoming 2010-11, Cambridge University Press).

In recent articles, I have argued that most of the causes of the global financial crisis can be divided conceptually into the categories of conflicts, complacency, complexity, and a type of tragedy of the commons. I sometimes refer to these as the ‘3Cs and the TOC.’ One might propose a fourth ‘C’: cupidity, or greed. But greed is so ingrained in human nature and so intertwined with the other categories that it adds little insight to view it as a separate category. Government cannot meaningfully legislate against greed. Moreover, in moderation, greed is positive, stimulating trade and commerce through the profit motive.

My talk today is on complexity, which I regard as the greatest 21<sup>st</sup> Century challenge for our financial system.

Complexity in financial markets does not *necessarily* “arise for complexity’s sake, nor from a desire to obfuscate.” Rather, it arises in response to “demand by investors for securities that meet their investment criteria and their appetite for ever higher yields” and in order to facilitate the transfer and trading of risk to those who prefer to hold it, promoting efficiency.

Nonetheless, complexity can also impair markets and investments in several interrelated ways.

#### A. Complexities of the Assets Underlying Investment Securities, and of the Means of Originating those Assets

The complexities of the assets underlying investment securities, and of the means of originating those assets, can lead to a failure of lending standards and unanticipated defaults. Consider the complexities of the underlying assets, which can include mortgage loans and a wide range of other financial assets. Each type of underlying asset requires a separate approach to modeling, including estimation of default risk, interest rate risk, and prepayment risk. To further complicate matters, prepayment risk is correlated with interest rate risk: when rates fall, borrowers are more likely to prepay; and when rates rise, borrowers are more likely to default. These risks are also dynamic in that they fluctuate over time.

The complexities of the means of originating these assets also can lead to a failure of lending standards. For example, the originate-to-distribute model of mortgage lending, under which mortgage lenders would sell off loans as they were made, is believed to have contributed to the financial crisis—although at tomorrow’s lecture I will question that belief.

Next consider complexities of the securities backed by these assets.

### B. Complexities of Modern Investment Securities

The financial crisis involved mortgage-backed securities. Because they are somewhat representative of modern investment securities, I will use them as a model, to provide perspective.

In their most basic form, mortgage-backed securities (“MBS”) are issued by a special-purpose vehicle (“SPV”), and payment on the securities is derived directly from collections on mortgage loans owned by the SPV.

More complex forms of mortgage-backed securities include collateralized debt obligation (“CDO”) securities, in which payment derives directly from a mixed pool of mortgage loans and sometimes, also, other financial assets owned by the SPV; and ABS CDO securities, in which payment derives from MBS and CDO securities owned by the SPV (and thus indirectly from the mortgage loans and other financial assets underlying those securities).

*Complexities of Securities Can Impair Disclosure.* Complexity can deprive investors and other market participants of the understanding needed for markets to operate effectively. Even if all information about a complex structure is disclosed, complexity increases the amount of information that must be analyzed in order to value the investment with certainty. According to rational ignorance theory, there is a point at which the benefit obtained from additional analysis can be outweighed, or at least appear to be outweighed, by the costs of performing that analysis.

The complexity of many modern investment securities appears to exceed that point. Investment analysts thus often resort to simplifying heuristics, such as credit ratings, as substitutes for attempting to fully understand the investments being analyzed.

*Complexities of Securities Can Obfuscate Consequences.* When securities are highly complex, parties reviewing, or even structuring, the securities may not always appreciate all the consequences. The complexities of securities also can obfuscate consequences when payoffs are linked to unrelated events, or “nonlinear.” For example, derivative instruments can

have payoffs that are not linearly related to the prices of their underlying securities.

The complexities of securities can also obfuscate consequences when trying to assess investment risk. With limited time to devote to this task, a firm's senior managers often want risk to be modeled and reduced to useable numbers. Any model, however, can be manipulated.

For example, as the VaR, or value-at-risk, model for reducing investment risk to a number became more accepted, banks began compensating analysts not only for generating profits but also for generating profits with low risks, measured by VaR. Analysts then began to select securities, such as complex forms of MBS and credit-defaults swaps, that have high rates of return and only rarely have losses. Because the likelihood of these losses was less than the risk percentages taken into account under VaR modeling—which typically excludes losses that have less than a one-percent (or, in some cases, five-percent) likelihood of occurring within the model's limited time frame—such losses were not included in the VaR computations. Analysts knew but did not always make clear to senior management that in the rare cases where such losses occurred, they could be huge.

*Complexities of Securities Can Make Financial Markets More Susceptible to Financial Contagion.* The complexities of securities can make financial markets more susceptible to financial contagion. In the recent crisis, for example, overreliance on “investment grade” ratings—as a substitute for trying to understand the complexity—meant that when certain

investment-grade securities starting losing money, investors panicked fearing that other investment-grade rated securities would likewise default.

*Complexities of Securities Can Make Financial Markets More Susceptible to Fraud.* Complexity also can facilitate fraud, especially in the case of complex asset-backed securities transactions. When a company issues corporate bonds, investors purchase the bonds based on the company's ability to repay, which ties strongly to the company's reputation for financial integrity and governance. Although there certainly have been frauds where the reality belied the company's reputation, a reputation built up slowly is hard to fake.

The use of asset-backed securities, however, enables even companies without good public reputations to obtain capital-market financing indirectly by using their financial assets. Although much is done to monitor these assets, due-diligence monitoring is not foolproof because it does not micromanage all uses and sources of cash and also because the servicer is not usually independent of the company.

### C. Complexities of Modern Financial Markets

The complexities of modern financial markets can aggravate these failures. Financial markets are effectively complex networks comprised of individual firms and markets that are both interconnected and interactive. The most straightforward interconnection is through contracting, such as derivatives contracts. The failure of a given market participant can cause a default on its obligations to other market participants, who, in turn, may

default on their own obligations to yet other market participants, leading to a domino-effect collapse.

The ability of modern financial markets to transmit information rapidly, often instantaneously, exemplifies market interactivity. This ‘tight coupling’ can exacerbate the impact of information failure or uncertainty. For example, newly developed trading technologies have greatly increased the speed of processing and trading on information. High-frequency algorithmic trading systems, relying on computerized models, are now capable of analyzing vast quantities of market data and transmitting thousands of order messages per second. Because of the speed with which this trading occurs, erroneous trades can lead to substantial losses before they are discovered. Furthermore, automated stop-loss orders based on pre-set criteria can trigger a chain reaction of selling, without the time or opportunity for human judgment to intervene.

In this type of complex environment, regulation can easily lead to unintended consequences. Mark-to-market, or “fair value,” accounting, for example, is generally believed to reduce risk. Nonetheless, it can cause perverse effects on systemic stability during times of market turbulence. As the recent crisis showed, forcing sales of assets to meet margin calls can depress asset prices, requiring more forced sales (which, in turn, will depress asset prices even more), causing a downward spiral.

How should these failures resulting from complexity be addressed?

## ADDRESSING MARKET FAILURES RESULTING FROM COMPLEXITY

These failures are, broadly, driven by (a) information uncertainty, (b) nonlinear feedback and tight coupling, and (c) misalignment of interests and incentives among market participants. These types of failures are similar to those that engineers have long faced when working with complex systems that have nonlinear feedback effects. Moreover, many characteristics of complex engineering systems are similar to those of financial markets.

For these reasons, any analysis of market failures resulting from complexity should take into account the “chaos theory” that helps to inform engineers about complex systems with nonlinear feedback effects.

### A. Addressing Information Failures Arising from Uncertainty

Uncertainty can cause a variety of financial-market failures, most obviously impairing securities disclosure. There are several potential ways to deal with this impaired disclosure: (i) to tolerate it; (ii) to prohibit transactions with impaired disclosure or otherwise attempt to reduce uncertainty; and (iii) to implement supplemental protections to minimize the impairment.

Toleration does not work because impaired disclosure makes securities markets inefficient. Prohibiting transactions with impaired disclosure does not work because it would inadvertently ban many beneficial transactions.

Regulatory attempts to limit uncertainty are unlikely to work. The most obvious approach would be to attempt to standardize financial products. But standardization would undermine the efficiencies that arise when securities are tailored to the particular needs of investors. Even the Dodd-Frank Act in the United States, which attempts to require centralized clearing and settlement of derivative contracts in order to manage counterparty risk, recognizes that the standardization needed to effectuate centralized clearing and settlement should not include all derivatives.

Implementing cost-effective supplemental protections therefore appears to be the best approach to the problem of impaired disclosure. These protections could include guaranties by sellers, such as warranties; and certifications of quality.

In a limited sense, the Dodd-Frank Act mandates a form of seller “guaranty,” by requiring sellers of mortgage- and other asset-backed securities to hold minimum unhedged exposure to the securities being sold. In this way, the seller puts “skin in the game” to signal its belief in the safety of the securities. This approach, however, can sometimes backfire.

For example, prior to the financial crisis, underwriters customarily purchased some “first loss” portion of the subordinated “equity” tranches of ABS CDO securities to demonstrate their belief in the securities being sold. Unfortunately, at least some of these underwriters did not fully understand the risks associated with their retained tranches, resulting in what I referred to yesterday as a ‘mutual misinformation’ problem; by signaling its

(unjustified) confidence in the securities being sold, the seller inadvertently misleads investors into buying those securities.

Certifications of quality can also improve securities disclosure, especially where the certification achieves an economy of scale. This type of approach is currently employed, for example, through rating-agency ratings on debt securities. In the recent crisis, however, rating agencies were said to contribute to the crisis.

There are no perfect solutions to the problem of uncertainty. Government already mandates minimum investor sophistication for investing in complex securities, yet the most sophisticated financial institutions are the very investors who lost the most money in the global financial crisis.

#### B. Addressing Failures Arising from Nonlinear Feedback and Tight Coupling

Perhaps the most significant combination of nonlinear feedback and tight coupling has been marking to market. The downward spiral it caused could have been mitigated, if not prevented, by recognizing that when investors lose confidence and markets become turbulent, marking to market can be misleading and potentially dangerous. One possible solution, for example, would be to allow a firm otherwise required to mark to market to have the option, instead, to disseminate full disclosure of its underlying asset portfolio.

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

One such possible approach is to establish a governmental entity to act, if needed, as a market liquidity provider of last resort in order to more loosely couple the feedback effects. This approach takes inspiration from chaos theory, which recognizes that failures are almost inevitable in complex systems, and that most successful systems are those in which the consequences of a failure are limited. This approach is also consistent with engineering design, in which de-coupling systems through modularity helps to reduce the chance that a failure in one part of a complex system will systemically trigger a failure in another part. When a component of a system fails, modularity enables repairs to be made before the entire system shuts down.

A market liquidity provider of last resort could work in much the same way: not only reducing the chance of any given financial market collapse by restoring liquidity but also reducing systemic risk by de-coupling the chance that a failure in one market would trigger a failure in other markets.

I will not go into the details of how such a market liquidity provider could work because I discussed that yesterday, when I introduced the idea. I would only observe further that the role of a market liquidity provider of last

resort would go substantially beyond the U.S. Federal Reserve's historical actions as lender of last resort to financial institutions, much less the actions of other national central banks.

### C. Addressing Failures Arising from Misalignment of Incentives

Complexity causes several types of misalignment that can give rise to financial-market failures. Consider first misalignment caused by the originate-to-distribute model.

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

As one solution to the moral hazard problem caused by this misalignment, regulators could (and in the U.S. and, I believe, Europe they now do) require loan originators to retain some realistic risk of loss—the “skin in the game” that I previously mentioned. Unfortunately, this solution still faces the mutual misinformation problem.

Misalignment can also cause failure in the form of fraud. For example, current best-practice monitoring procedures in asset-backed securities transactions are not failsafe because the servicer is not usually independent of the company originating the underlying financial assets. An affiliated servicer can manipulate monitoring in ways that are undetectable unless investors, or their agents, micromanage all uses and sources of cash.

In practice, asset-backed securities transactions may evolve to use independent, third-party servicers, in order to increase investor comfort. But regulation should not impose that requirement; parties should have the flexibility to decide, for example, not to use an independent servicer when they trust an affiliated servicer. There is nothing inherently wrong or unusual for parties in business transactions to deal with each other on the basis of trust.

Nonetheless, the potential for government to impose that requirement can be valuable because investors tend to have short memories. Experience has shown that once a crisis recedes in memory, they will almost always tend to “go for the gold.” There may come a time when regulation, or its threat, is needed to restore market discipline.

Finally, misalignment can cause failure when conflicts exist among a firm’s managers, such as when investment analysts resort to simplifying heuristics when analyzing highly complex securities or—as in the case of VaR—manipulate models for their pecuniary advantage. This “*secondary-manager*” conflicts problem can be addressed by better aligning

management compensation incentives with the long-term interests of the firm.

Firms have incentives, and are in a better position than government regulators, to determine how best to align their long-term interests with manager compensation. Alignment is difficult to achieve, however, because individual firms that attempt to align incentives will be disadvantaged in their ability to compete for the best managers. Regulation may well be needed to help resolve this collective-action problem. And, because firms are increasingly global and top managers can move among nations, any such regulation would almost certainly have to be international in order to avoid prejudicing nations that individually require manager compensation to be aligned with long-term firm interests.

#### D. Another Approach to Addressing Systemic Market Failures

Another possible approach to addressing systemic market failures would be to disrupt the mechanism by which systemic shocks are transmitted. The problem is that there may be multiple transmission mechanisms, which may change over time.

Nonetheless, based on a study of four financial crises in the past century (including the Great Depression and the recent global financial crisis), Professor Iman Anabtawi of UCLA and I have attempted to describe at least one such transmission mechanism. We argue that two otherwise independent correlations can combine to transmit localized economic shocks into broader systemic crises.

The first is an *intra*-firm correlation between a firm's financial integrity and its exposure to risk from low-probability adverse events that either constitute or could lead to economic shocks. The second is an *inter*-institutional correlation among financial firms and markets.

Although the causes of the Great Depression are still being debated, these two correlations, working in combination, appear to have been important causal factors. Prior to the Depression, many banks engaged in margin lending to risky borrowers, securing the loans by shares of stock that the borrowers purchased with the loan proceeds. The value of the stock collateral started out being at least equal to the amount of the loan, and banks assumed that the stock market, which had been continuously rising in value for years, would continue to rise, or at least not decline, in value.

This illustrates the *intra*-institutional correlation between low-probability risk—in this case, the risk that collateral value may become insufficient—and firm integrity. Bankers failed to appreciate this correlation.

The Depression also illustrates how the first correlation, in combination with an *inter*-institutional correlation among financial institutions (in this case, an interconnectedness among banks), can potentiate the transmission of an economic shock into a broader systemic shock. Some banks lost so much money in margin lending that they themselves became unable to pay their debts, including debts owed to other banks. As a result, defaults by margin-lending banks affected other banks' ability to meet their obligations to yet other banks, and “so on down the chain of banks and beyond.”

Similarly, the global financial crisis almost certainly was caused, or at least exacerbated, by the two correlations working in combination. Subprime mortgage loans were bundled together as collateral to partially support the payment of complex mortgage-backed securities that were sold to banks and other financial firms worldwide. These securities maintained their value so long as home prices appreciated, as they had been doing for decades and as market observers assumed would continue.

When home prices began falling, some of these mortgage-backed securities began defaulting, requiring financial firms heavily invested in these securities to write down their value, causing these firms to appear, if not be, financially risky. This represented a failure of these firms to see, or at least to fully appreciate, the correlation between low-probability risk—the risk that home prices would significantly fall—and firm integrity.

The financial crisis also involved a failure to see a correlation among financial institutions—in this case, a failure to see *not only* the tight interconnectedness among banks and non-bank financial firms *but also* the tight interconnectedness between financial firms and markets. What made the financial crisis so devastating was that these failures combined to facilitate the transmission of economic shocks.

Professor Anabtawi and I argue that the 3Cs and the TOC, which I referenced at the outset of this talk, make it unlikely that market participants can be relied on to protect against these types of correlations combining, without regulatory intervention. The need for appropriate regulatory

intervention is urgent because increasing complexity within the financial system will make these correlations increasingly likely to arise, as well as to combine, in the future. And complexity *is* virtually certain to increase. Profit opportunities are inherent in complexity, due in part to investor demand for securities that more precisely match their risk and reward preferences. Regulatory arbitrage creates complexity, such as when market participants take advantage of inconsistent regulatory regimes both within and across national borders. And new technologies will continue to add complexity not only to financial products but also to financial markets.

#### E. Subjects of Future Inquiry

There are not only many unresolved questions associated with complexity but also questions that have not been, *or are only beginning to be*, asked. One of these is whether the complexity caused by risk dispersion can lead to market failures that cause market participants to underestimate and under-protect against risk—what I call the ‘marginalization’ of risk.<sup>2</sup> I attempt to begin to engage this question in a new paper being work-shopped at LSE and Queen Mary University of London next week. If anyone is interested, please feel free to e-mail me, or see me after today’s lecture, and I’ll forward you a working draft.

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<sup>2</sup> Cf. Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, 93 MINN. L. REV. 373, 390-91 (2008) (asking whether structured finance dispersed subprime mortgage risk so widely that no investor had a clear incentive to monitor it).