February 19, 2021

Vanessa Countryman
Secretary
Securities and Exchange Commission
100 F Street NE., Washington, DC 20549

Re: ***File No. 4-698; Joint Industry Plan; Notice of Filing of Amendment to the National Market System Plan Governing the Consolidated Audit Trail by the Plan Participants—Comment Letter of the Securities Industry and Financial Markets Association***

Dear Ms. Countryman:

On behalf of Securities Industry and Financial Markets Association ("SIFMA")[1] and as referenced in our comment letter dated January 27, 2021, enclosed is a White Paper prepared by Professor Craig M. Lewis entitled "Economic Analysis of Proposed Amendment to National Market System Plan Governing the Consolidated Audit Trail." As set forth in the White Paper, Professor Lewis disagrees with the Charles River Associates report accompanying the proposed amendment and concludes that the proposed amendment, if adopted, would result in a reduction in investor welfare.

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SIFMA greatly appreciates the Commission's consideration of these comments and would be pleased to discuss them in greater detail. If you have any questions or need any additional information, please contact me at [redacted] or [redacted].

Sincerely,

Ellen Greene

Ellen Greene
Managing Director
Equity and Options Market Structure

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1 SIFMA is the leading trade association for broker-dealers, investment banks and asset managers operating in the U.S. and global capital markets. On behalf of our industry's nearly 1 million employees, we advocate for legislation, regulation and business policy, affecting retail and institutional investors, equity and fixed income markets and related products and services. We serve as an industry coordinating body to promote fair and orderly markets, informed regulatory compliance, and efficient market operations and resiliency. We also provide a forum for industry policy and professional development. SIFMA, with offices in New York and Washington, D.C., is the U.S. regional member of the Global Financial Markets Association (GFMA). For more information, visit http://www.sifma.org.

cc: Acting Chair Allison H. Lee
Commissioner Hester M. Peirce
Commissioner Elad L. Roisman
Commissioner Caroline A. Crenshaw

Christian Sabella, Acting Director, Division of Trading and Markets
Hugh Beck, Regulatory Reporting Advisor to Acting SEC Chair

Economic Analysis of Proposed Amendment to National Market System Plan Governing the Consolidated Audit Trail

Craig M. Lewis, Ph.D.*

February 2021

* I am the Madison S. Wigginton Professor of Finance and Professor of Law at Vanderbilt University. I also am a Senior Advisor at Patomak Global Partners. This white paper was commissioned by the Securities Industry and Financial Markets Association. I was supported in writing this white paper by staff of Cornerstone Research, who worked under my direction. A copy of my CV is attached as Appendix A.

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I. Introduction

1. This comment is with regard to the proposed amendment ("Proposed Amendment") to the National Market System Plan Governing the Consolidated Audit Trail (the "CAT NMS Plan") filed by Consolidated Audit Trail, LLC ("CAT LLC") that would obligate all industry members ("Industry Members") to assume substantially all liability associated with a breach or misuse of data in the Consolidated Audit Trail (the "CAT") System by requiring Industry Members to sign limitation of liability provisions.[1]

2. The Proposed Amendment contains an economic analysis that was prepared by Charles River Associates ("CRA Report") that concludes that the benefits of the Proposed Amendment outweigh the economic costs. I disagree with that conclusion. As I will discuss more fully below, a key limitation of the CRA Report is that it fails to account for the costs that Industry Members would incur if a breach or misuse of CAT Data resulted in litigation against them by their customers. Although it is difficult to quantify the incremental economic costs of a data breach and any associated litigation, the CRA Report directly states that "[i]t is well-understood that litigation in general is an expensive and highly uncertain process. This holds with particular persuasiveness for the new, highly technical, and rapidly changing area of cyber security."[2] Since these costs are expected to be substantial, they should be included in any well-executed economic analysis.

3. My economic analysis of the underlying issues shows that the Proposed Amendment, if adopted, would result in a reduction in investor welfare. Investors would be at greater risk of having their data compromised since CAT LLC's incentives to invest in security to protect the CAT Data would be reduced. Since Industry Members do not have the ability to directly control the security of the CAT Data, it will likely require their purchase of additional liability insurance beyond their existing coverage to address the risk of a breach or misuse of that data. However, requiring Industry Members to absorb litigation-related expenses for a causality over which they have no direct control is inefficient, as they do not have nor can they grant access to insurers to

[1] Release No. 34-90826 (December 30, 2020), 86 FR 591 (January 6, 2021) ("Proposed Amendment").
[2] Charles River Associates, "White Paper: Analysis of Economic Issues Attending the Cyber Security of the Consolidated Audit Trail," December 18, 2020 ("CRA Report"), p. 79.

monitor or assess the security of the CAT System. This will result in higher insurance costs, which will ultimately be passed-on to investors. In contrast, if CAT LLC were to internalize *all* of the costs associated with reimbursing investors in the event of a breach or misuse of CAT Data, it would result in a more efficient insurance choice. Based on economic first-principles, I expect that CAT LLC would be able to purchase such coverage at lower prices than would be available to Industry Members because it has full access to the CAT System and can subject itself to monitoring by insurers.

II. Background and Implications of Proposed Amendment

4. On July 18, 2012, the U. S. Securities and Exchange Commission ("SEC") adopted Rule 613 which called for self-regulatory organizations ("SROs") to jointly submit a plan to create, implement, and maintain "a comprehensive consolidated audit trail that would allow regulators to efficiently and accurately track all activity throughout the U.S. markets in National Market System (NMS) securities."[3] In particular, it envisioned a single comprehensive database "that would capture customer and order event information for orders in NMS Securities and OTC Equity Securities (Eligible Securities), across all markets, from the time of order inception through routing, cancellation, modification, execution, and allocation."[4] After various amendments and seeking comments, the proposed CAT NMS Plan was approved by the SEC on November 15, 2016.[5]

5. As of August 29, 2019, the SROs established CAT LLC as the legal entity to carry out the activities related to the CAT.[6] In particular, CAT LLC is the entity that Industry Members

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[3] SEC, "Rule 613 (Consolidated Audit Trail)," modified December 17, 2020, available at https://www.sec.gov/divisions/marketreg/rule613-info htm (accessed on February 9, 2021); Consolidated Audit Trail, 17 CFR Parts 242, effective October 1, 2012, available at https://www.sec.gov/rules/final/2012/34-67457.pdf (accessed on February 9, 2021).

[4] "CAT Reporting Technical Specifications for Industry Members," January 8, 2021, p. 1, available at https://www.catnmsplan.com/sites/default/files/2021-01/1.08.21_CAT_Reporting_Technical_Specifications_for_Industry_Members_v4.0.0r5_Clean.pdf (accessed on February 9, 2021).

[5] SEC, "SEC Approves Plan to Create Consolidated Audit Trail," November 15, 2016, available at https://www.sec.gov/news/pressrelease/2016-240 html (accessed on February 9, 2021).

[6] CAT FAQ, "A1. Has a legal entity been established to conduct the activities related to the CAT?" updated January 29, 2021, available at https://www.catnmsplan.com/faq (accessed on February 9, 2021).

are required to report their data to and is responsible for collecting, maintaining, and securing that data.

6. The CAT Data maintained by CAT LLC includes both market data, which contains all the order event information across the lifecycle of all transactions in the U.S. equity and options markets, as well as personally identifiable information ("PII") for regulators to use for the investigation of misconduct.[7]

7. After reporting its data to CAT LLC, Industry Members have no control over the security of the data and bear **no responsibility for its safekeeping**. It is CAT LLC that is responsible for addressing "the security and confidentiality of all information accessible from the CAT and the operational risks associated with accessing the CAT."[8] One of the structural precautions taken to protect the CAT Data is to separate it into three distinct systems, two of which contain PII data and one that contains trade data. The purpose of this setup is to anonymize the data and provide an extra layer of security between the market data and the PII.[9] Other security precautions include: the three systems are controlled and maintained by different personnel, each system is "encrypted independently of each other using different keys," and the data system with customer and account attributes (CAIS database) has limited permissions and does not allow data to be extracted.[10]

8. Despite the security requirements adopted and precautions taken by CAT LLC, it does not rule out the possibility of a breach or misuse of data by potential bad actors or SRO employees. This is noted in the CRA Report as well, that "[a]n unfortunate fact of the cyber world is that the best standards, policies, and procedures all executed with perfection may not thwart every conceivable breach attempt."[11] The CRA Report concludes that, "most potential breaches are relatively low-frequency events;" however, the CRA Report also acknowledges that

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[7] CAT, "FAQs S5. What type of information is in the CAT?" updated January 29, 2021, available at https://www.catnmsplan.com/faq (accessed on February 9, 2021); CRA Report, Figure 2.

[8] CAT FAQ, "S1. What steps are being taken to ensure that the CAT is secure given heightened cybersecurity concerns?" updated January 29, 2021, available at https://www.catnmsplan.com/faq (accessed on February 9, 2021).

[9] The two systems that contain PII data are the CAT Customer ID ("CCID") Subsystem and the Customer and Account Information System ("CAIS"). The CCID Subsystem contains transformed identifiers ("TID") received from the Industry Members, which are "transformed [values] of an ITIN, SSN, or EIN associated with an account holder or authorized trader," and their generated corresponding CAT Customer ID ("CCID"), which are not shared with Industry Members. The CAIS contains reported customer and account attributes from Industry Members and their associated CCID. CRA Report, pp. 51–52, Figure 2.

[10] CRA Report p. 44.

[11] CRA Report, p. 35.

any such breach could be "catastrophic."[12] Regardless of this assessment, it appears that the SEC was sufficiently concerned about data security that it proposed amendments to the CAT NMS Plan in August 2020 that removed the collection of certain sensitive PII (such as social security numbers and date of birth) and included further security requirements.[13] Furthermore, additional precautions will likely need to be implemented over time as new vulnerabilities emerge and bad actors develop new techniques.

9. In the Proposed Amendment, CAT LLC seeks to force Industry Members to assume liability associated with a data breach or any misuse of CAT Data by signing limitation of liability provisions. CAT LLC's attempt to mitigate its liability and shift litigation costs to Industry Members suggests that concerns of significant risks associated with potential data breaches and misuse of CAT Data exist. This is at odds with recent comments submitted by the SROs that suggest the CAT Data are sufficiently secure and that they oppose the SEC's proposed security enhancements.[14] Furthermore, if there was little to no risk of litigation, there would be no need to ask for a liability waiver.

10. If the Proposed Amendment is adopted and a data breach occurs, Industry Members would likely be the subject of claims by their clients and sued as a result of any damages suffered by those whose data were compromised.[15] Since Industry Members face the consequences of a breach but are not in control of the CAT Data and have no ability to directly mitigate the security risk, the only option potentially available to them will be to purchase additional cyber liability insurance.

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[12] CRA Report, p. 21.

[13] SEC, "SEC proposes Data Security Enhancements to the CAT NMS Plan," August 21, 2020, available at https://www.sec.gov/news/press-release/2020-189 (accessed on February 9, 2021). For example, one of the proposed measures was a limitation on the maximum number of records that could be downloaded by regulators using an online query tool. Another proposed measure was the creation of a Secure Analytical Workspace ("SAW"), an analytic environment part of the CAT System where CAT data would be accessed and analyzed.

[14] Michael Simon Comment Letter, December 4, 2020, p. 1, available at https://www.sec.gov/comments/s7-10-20/s71020-8100247-226195.pdf (accessed on February 9, 2021). ("The Participants have implemented robust protections to protect the security and confidentiality of CAT Data, and share the Commission's view that CAT Data reported to and retained in the Central Repository currently is subject to stringent security policies, procedures, standards and controls"). See also Cboe Comment Letter, December 2, 2021, p. 5, available at https://www.sec.gov/comments/s7-10-20/s71020-8088156-226116.pdf (accessed on February 9, 2021). ("The proposed restrictions on Participants' access to CAT Data are not necessary to ensure that CAT Data is protected by appropriate security controls, policies, and procedures, and the Commission has identified no reason to believe otherwise").

[15] In the event of a data breach or misuse of data, there are a number of ways in which the compromised data could cause harm. Some examples include: the reverse engineering of certain algorithms by analyzing the transaction data, identity theft by using compromised personal information, or the revealing of certain information that might harm a person's reputation. This is not an exhaustive list of how bad actors could misuse any compromised CAT Data to cause harm.

III. Economic Analysis of the Proposed Amendment

11. My economic analysis of the Proposed Amendment shows that investors would be harmed if the Proposed Amendment is adopted for two reasons: 1) it is more likely that investors would be harmed through the compromise of their data (PII and trading data) as CAT LLC is incentivized to invest less in data security to protect the CAT Data if it does not retain potential liability, and 2) the costs of insurance (which almost certainly would be passed downstream to investors) will be higher if purchased by Industry Members individually as compared to by CAT LLC on behalf of all Industry Members. I discuss each of these reasons in greater detail below.

A. Alignment of Control and Liability Incentivizes the Optimal Amount of Data Security and Ultimately Benefits All Investors

12. The Proposed Amendment, if adopted, would sever the link between bearing the risk of a data breach from the responsibility of guarding against such a possibility. This would result in a classic example of moral hazard, where CAT LLC's incentives to invest in data security would be diminished since Industry Members, rather than CAT LLC, would bear the potential litigation costs of a breach or misuse of CAT Data.[16] If a liability waiver were granted, the economically efficient investment in data security for CAT LLC would lead to underinvestment and a greater risk of a breach or misuse of data in the CAT System relative to what the optimal investment would be if CAT LLC was responsible for compensating Industry Members for any litigation costs associated with a breach or misuse of CAT Data.

13. As discussed above, an example of this can be seen in the comments submitted by SROs that opposed the adoption of security enhancements proposed by the SEC.[17] If CAT LLC

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[16] It would also reduce the incentive for CAT LLC and SROs to prevent their own employees from using the CAT Data in an inappropriate manner.

[17] Michael Simon Comment Letter, December 4, 2020, p. 3, available at https://www.sec.gov/comments/s7-10-20/s71020-8100247-226195.pdf (accessed on February 9, 2021). ("The Participants believe, and as noted in the Proposing Release, the Commission has concurred that a robust security system has been developed and implemented for the CAT….the Participants recommend that the SEC not move forward with the proposal."); Nasdaq Comment Letter, December 2, 2020, p. 2, available at https://www.sec.gov/comments/s7-10-20/s71020-8084827-226094.pdf (accessed on February 9, 2021). ("The Proposal underestimated the costs associated with the Proposal, and fails to establish that sufficient benefits exist to justify imposing such costa [*sic*] on the industry, the SROs, and, ultimately, investors."); Cboe Comment Letter, December 2, 2020, p. 5, available at https://www.sec.gov/comments/s7-10-20/s71020-8088156-226116.pdf (accessed on February 9, 2021). ("The proposed restrictions on Participants' access to CAT Data are not necessary to ensure that CAT Data is protected by appropriate security controls, policies, and procedures, and the Commission has identified no reason to believe otherwise."); NYSE Comment Letter December 2, 2020, p. 34, available at https://www.sec.gov/comments/s7-10-20/s71020-8083358-226075.pdf ("In short, the Proposal would fundamentally shift the purpose, utility, and cost of the CAT with the purported goal of improving security, but

remains potentially liable for data breaches, it should be willing to undertake additional security investment until the marginal costs of such investment are equal to the marginal benefit of reducing potential damages from litigation. However, if CAT LLC can avoid liability for litigation brought by or against Industry Members arising from a CAT data breach, it would be less incentivized to undertake additional investments beyond what is currently mandated by regulation.

14. Furthermore, because of the structure and governance of CAT LLC, Industry Members do not have access to the details of CAT LLC's cyber security nor do they have the ability to directly implement additional security precautions in response to underinvestment by CAT LLC. The CRA Report claims "the SEC's regulatory process for the CAT permits parties affected by the operation of the CAT to stay informed of the operation of the CAT's cyber risk program and to advocate for and incorporate any broader security concerns."[18] However, the ability to advocate for change in such a way is not an efficient or effective way to optimize the security of the CAT Data. It would also be difficult for an outside party to give concrete suggestions on how to protect the CAT Data when it does not have direct access to the system, familiarity with the details of the security program, or any awareness of attempted breaches.[19] Moreover, even if Industry Members could make suggestions that receive consideration, they would have no control or oversight on the implementation of these proposals or even a way to verify if the suggested changes have been made.

15. As the CRA Report notes, "[t]he concern, therefore, is that entities may choose to not invest at a socially optimal level of protection if they do not internalize the expected direct costs of the potentially breached entity as well as the costs of all other affected parties."[20] This is precisely the point that concerns Industry Members. The costs not being internalized by CAT LLC are the litigation costs related to breaches of the CAT Data that would instead be borne by Industry Members under the Proposed Amendment.

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without adequately identifying specific security problems that could not be addressed within the existing CAT security framework and requirements of the CAT NMS Plan.").

[18] CRA Report, p. 35.

[19] I note that the CRA Report points to a lack of specific deficiencies in the CAT's cybersecurity program as evidence of the CAT's robust cybersecurity. (CRA Report, p. 18). However, as I noted, it is difficult for outsiders to give concrete proposals on the security system with which they are unfamiliar. Furthermore, the lack of specific proposals does not detract from the underlying argument that the incentive to protect the data is best achieved by aligning control and liability.

[20] CRA Report, p. 71.

16. It would be more effective for CAT LCC itself to be incentivized to invest in security at a level that considers *all* costs of operating the CAT. That is, it should consider the indirect costs of all parties as well as its direct costs. In particular, the indirect costs are the litigation-related costs connected with the compromise of the CAT Data. The most effective way to "internalize" these costs would be for CAT LLC to retain liability. Otherwise, contrary to the CRA Report's claims, CAT LLC's incentives are not aligned with those of Industry Members.[21]

17. To be clear, CAT LLC does have some incentive to invest in cybersecurity—it is still mandated to remain in compliance with certain regulations. However, the marginal costs and benefits faced by CAT LLC to invest further in data security are no longer the same as Industry Members under the Proposed Amendment since Industry Members may be sued by their customers should the data be compromised, but Industry Members cannot sue CAT LLC to recover any related costs.

1. CAT Cyber Security Can Benefit from Having Both Ex-Ante Regulation as well as Ex-Post Litigation

18. The CRA Report asserts that, "Industry Members have argued that the risks associated with a CAT cyber breach are best addressed through litigation they can initiate as opposed to regulation and, if necessary, enforcement action by the SEC."[22] This is a mischaracterization of Industry Members' position. I understand from counsel that Industry Members have not requested to remove the existing regulation of CAT LLC by the SEC or asserted that litigation *alone* is preferable to regulation with regards to the security of the CAT Data. Rather, Industry Members oppose the limitation of liability provisions in order to preserve their ability to sue CAT LLC in the unfortunate instance of a breach or misuse of CAT Data *even* if CAT LLC is regulated by the SEC. That is, Industry Members are concerned regarding the change in incentives when moving from a model of both regulation and litigation to one that solely relies on regulation.

19. As the CRA Report notes, the use of regulation and litigation are not mutually exclusive and there are many instances where these policy tools are used jointly.[23] For example, the CRA

[21] CRA Report, p. 39.
[22] CRA Report, p. 76.
[23] CRA Report, p. 69.

Report points to the financial services, health, safety, food, and drug industries where baseline regulatory requirements exist but where parties that suffer harm are still able to sue to recover damages.[24] The CRA Report argues that such an arrangement is not optimal as the benefits of allowing Industry Members to litigate against CAT LLC do not outweigh the costs.[25]

20. However, the analysis in the CRA Report ignores risks and costs associated with customers of Industry Members potentially bringing suit against Industry Members if their data is compromised.[26] Regardless of whether there was a good faith effort to protect the data with careful regulation and aggressive enforcement, the possibility of a breach or misuse of CAT Data remains. In such an event, it is likely that customers will bring suit against Industry Members. If the costs related to such litigation were also considered in the CRA Report's economic analysis, it would show that requiring the parties that have access to and are responsible for protecting the data to bear these costs leads to better incentive alignment.

21. In the CRA Report's economic analysis, it claims that CAT LLC's costs would increase "significantly" if litigation against CAT LLC by Industry Members were allowed.[27] However, it ignores the fact that Industry Members will bear those costs if CAT LLC is permitted to disclaim liability. If Industry Members could not sue CAT LLC, they would have to purchase additional liability insurance since they have no recourse to recoup any litigation-related losses from their own customers. Since CAT LLC has a better understanding of its own data security and any potential weaknesses, CAT LLC would be expected to be able to obtain less costly insurance than would be the case if Industry Members had to purchase additional liability insurance individually because there the moral hazard problem is less severe.[28] As costs are likely to be borne by investors ultimately in either case, there would actually be a reduction in costs passed on to investors from allowing litigation against CAT LLC from Industry Members.[29]

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[24] CRA Report, p. 69.

[25] CRA Report, p. 35.

[26] There is also a possibility that Industry Members themselves could similarly be harmed, suffer losses, and have claims against CAT LLC. (For example, consider an Industry Member who has no customers but has its proprietary models reverse-engineered as a result of a breach of CAT Data.) The use of ex-ante regulation is insufficient to address such situations.

[27] CRA Report, pp. 78–80, 88.

[28] Asymmetric information about data security between Industry Members and CAT LLC creates a moral hazard problem that, all else equal, would result in Industry Members paying higher insurance premia relative to what CAT LLC would pay were it to acquire the same level of coverage on behalf of Industry Members.

[29] This argument is based on the assumption that Industry Members would sue for litigation-related damages and would not seek punitive damage awards, such as those related to lost customers. It also recognizes that CAT LLC would be concerned that Industry Members would not be appropriately incentivized to resolve customer-initiated lawsuits in a cost-efficient manner,

22. The CRA Report also argues that there are no benefits to allowing Industry Members to sue CAT LLC, stating that "adding the threat of litigation would do nothing to further internalize into the CAT's decision making the possible losses suffered by the Industry Members."[30] On the contrary, if CAT LLC remains potentially liable, it would mitigate the moral hazard problem and help alleviate Industry Members' concerns about underinvestment in data security.[31] CAT LLC also should be more willing to invest in improvements in data security as new technology is developed. Rather than waiting for the regulators to publish official guidance or updates, CAT LLC would be incentivized to quickly react to changing trends and threats in cybersecurity. That type of rapid response is particularly important in the quickly evolving realm of technological advances. This is another reason against the use of regulation as the only incentive.

2. The Cited Example of Limitation of Liability Provisions Is Not Comparable

23. The Proposed Amendment claims that the limitation of liability provisions are industry-standard and "have been agreed to in substance by virtually all Industry Members in connection with Order Audit Trail System ("OATS") reporting."[32] This is not a suitable comparison to the CAT Data and overlooks several reasons for why such a comparison is flawed.

24. First, the CAT Data is far more comprehensive, and contains much more valuable information than the OATS Data, which makes it a more attractive target for potential bad actors and increases the risk accordingly. The majority of the data contained in OATS is public data that could be purchased. More importantly, it does not include any personally identifying information—at its most granular, the data provides an Account Type Code which only identifies whether the order was placed by an institutional or individual customer.[33] In contrast, Industry

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especially if Industry Members believed they could pass all litigation-related costs on to CAT LLC. Allowing Industry Members to sue CAT LLC for litigation costs related to data breaches would align incentives of both parties and lead to a more economically efficient outcome.

[30] CRA Report, p. 72.

[31] I note that it is possible that Industry Members may still choose to purchase additional insurance coverage depending on their customer base and their inherent degree of risk aversion. For example, it is possible that firms with institutional clients may want additional insurance (since losses from reverse engineering of proprietary models are higher) compared to firms which predominately serve retail investors.

[32] Proposed Amendment, pp. 2–3.

[33] FINRA, "OATS Web Interface Data Dictionary," p. 2, available at https://www.finra.org/sites/default/files/AppSupportDoc/p124221.pdf (accessed on February 9, 2021).

Members are required to report to CAT LLC "information of sufficient detail to identify a customer."[34] For individuals, this includes, the individual's name, address, year of birth, and a unique Firm Designated ID.[35] As the CRA Report notes, "personal information is the most common type of data compromised in a cyber breach" and the "CAT remains a tempting target for cybercriminals as it will have one of the largest accumulations of personal data ever assembled."[36] This puts the CAT Data at much greater risk of being targeted than the OATS data.

25. Second, the CAT System was designed with regular access in mind. The CAT NMS Plan states that, "[p]articipants' regulatory staff and the SEC will access CAT Data to perform functions, including economic analyses, market structure analyses, market surveillance, investigations, and examinations" and that approximately 600 users are expected to use the system on a daily or weekly basis.[37] The likely more frequent and broader use of this data exposes it to greater risk as compared to the OATS Data.

26. Lastly, the corresponding limitation of liability provisions for OATS were signed in 1998, more than two decades ago. Since then, the landscape of cybersecurity and the frequency and scale of data breaches has increased dramatically. The CRA Report notes this trend and cites to a recent report from the A.M. Best insurance credit rating agency which stated that "[c]yber insurance premiums will likely continue to rise . . . due to both rising claims costs and heightened risks... Over the past three years the number of cyber claims has doubled to 18,000 in 2019, from 9,000 in 2017."[38] It is not obvious that if those same limitation of liability provisions were proposed today, whether they would have been as widely agreed to.

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[34] CAT FAQ, "S6. What is Customer Account Information and Customer Identifying Information?" updated on January 29, 2021, available at https://www.catnmsplan.com/faq (accessed on February 9, 2021).

[35] CAT FAQ, "S6. What is Customer Account Information and Customer Identifying Information?" and "S7. How does the CAT protect social security numbers?" available at https://www.catnmsplan.com/faq (accessed on February 9, 2021); SEC, "SEC Proposes Data Security Enhancements to the CAT NMS Plan," August 21, 2020, available at https://www.sec.gov/news/press-release/2020-189 (accessed on February 9, 2021). Prior to the SEC's proposed data enhancements, Industry Members were also required to report customers' social security numbers/individual taxpayer identification numbers and date of birth.

[36] CRA Report, p. 54. See also, CRA Report, p. 44. ("More specifically, the CAT Customer and Account Attributes database (the CAIS database) is the only database that exists that aggregates, across all U.S. stock exchanges, elements of PII (name, address, birth year) for the over 100 million people, companies, and trusts, that hold accounts trading U.S. equities and options.")

[37] CAT NMS Plan, Appendix D: CAT NMS Plan Processor Requirements, February 27, 2015, Appendix D-24–Appendix D-25.

[38] CRA Report, p. 38, citing Ayers, Erin, "US cyber market keeps growing, but pace slowed: AM Best," Advisen Front Page News, July 22, 2020.

B. CAT LLC Is Uniquely Suited to Obtain the Optimal Insurance Coverage to Reimburse Investors in the Event of a Cyber Breach

27. Regardless of the amount of investment in cybersecurity and how many precautions are taken to safeguard the CAT Data, there remains the risk of a breach or misuse of the CAT Data. In the event of such a breach or misuse, a cyber-insurance policy can help provide relief in the form of payouts that can be used to reimburse claimants who suffered harm as a result of their data being compromised (whether PII or other data).

28. To maximize consumer welfare, an insurance policy should be purchased with coverage such that the marginal expected benefit (from the payouts in the event of a breach or misuse of CAT Data) is equal to the marginal cost (i.e., insurance premium associated with the level of coverage). Such insurance could either be purchased by CAT LLC (on behalf of all Industry Members) to cover all third-parties that would be harmed as a result of a data breach, or individual policies could be purchased by each individual Industry Member to cover potential claims by the investors who are their respective clients, or some combination of the two.[39]

29. The optimal level of coverage CAT LLC would purchase depends on whether it obtains a liability waiver. Since the marginal cost associated with a data breach is lower if it obtains a liability waiver, the optimal level of coverage purchased by CAT LLC would naturally be reduced. This implies that Industry Members face two separate but related underinvestment problems: the first relates to the investment in data security and the second relates to the level of insurance coverage CAT LLC would obtain.[40]

30. As I discuss below, investors would be better off if insurance was purchased by CAT LLC, which is responsible for safeguarding the data, as opposed to Industry Members which face higher premiums from insurers because they do not have access to the CAT System or control of its security measures.

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[39] See footnote 31 above.

[40] Regardless of the level of insurance CAT LLC obtains and whether it obtains a liability waiver, individual Industry Members will make decisions about whether to purchase additional insurance coverage to reflect their specific risk tolerances. One Industry Member may decide that the coverage provided by CAT LLC is inadequate and purchase additional coverage. Another Industry Member may believe that the level of coverage provided by CAT LLC is adequate and is willing to self-insure against the additional litigation costs associated with a breach or misuse of CAT Data.

1. CAT LLC Is Able to Pay Lower Premiums to Insurers Because of Insurers' Ability to Monitor

31. It is important to note that if a cyber-breach occurred, it is likely to be a single event that affects all Industry Members simultaneously. It is, of course, possible that certain firms are more at risk due to the nature of their clients, but from the standpoint of an insurer, the event that triggers a claim is the same for all Industry Members, even if the severity depends on the type of data taken or the individuals or entities that were targeted. As a result, even if insurance is purchased for all Industry Members, this is unlike the typical situation where the pooling of risk can reduce the volatility around claims. As an example, in health insurance, it may be cost-efficient for a group of individuals to purchase insurance together because the pooling of their individual risk allows the aggregate claims to converge to expected claims. This results in each individual paying a lower average insurance premium. However, for the CAT Data, the number of entities purchasing insurance does not affect the volatility of claims because no Industry Member is likely to be affected without all Industry Members being similarly affected at the same time.

32. However, even if CAT LLC does not benefit from the pooling of risk, it is still beneficial for CAT LLC to obtain insurance on behalf of all Industry Members instead of Industry Members purchasing policies individually. If an Industry Member were to purchase insurance, its insurers would not have the same ability to assess the robustness of CAT LLC's data security since Industry Members themselves are not fully aware of the details of CAT LLC's security processes and procedures nor do they have access to the CAT Data. In contrast, because CAT LLC has access to and control over the CAT Data, it can subject itself to monitoring by an insurer.

33. When insurers are able to monitor the policyholder (for example, by auditing their security procedures and sharing best practices) and have better insight into the underlying risk, they may be able to charge lower premiums. This is because monitoring helps alleviate the asymmetric information problem that insurers face. Examples of this can be seen in other insurance markets. For example, many insurers offer lower car insurance premiums for safer drivers where the determination is made through monitoring the driver's behavior using a device

on their vehicle.[41] CAT LLC is uniquely positioned to allow insurers to monitor its cybersecurity and take advantage of lower insurance premiums.

34. Monitoring and engagement by insurers may also lead to certain suggestions or requirements that can both lower the cost of insurance as well as improve the overall security of CAT LLC. This is noted in the CRA Report when they state that a "cyber insurance program also provides the benefit of engaging additional third parties (i.e., the insurance carriers) who have incentives and abilities to monitor cyber security hygiene at the CAT and the Plan Processor."[42] In contrast, if Industry Members purchased their own policies, not only would their insurers be unable to monitor CAT LLC, but even if they had suggestions to improve security (which would potentially lower premiums), Industry Members have no ability to force CAT LLC to comply and adopt the suggested security protocols.

2. There is No Basis for the Claim that CAT LLC Cannot Obtain Additional Insurance

35. In the Proposed Amendment, CAT LLC claims that it "has obtained the maximum extent of cyber-breach insurance coverage available."[43] Relatedly, the CRA Report states that "CAT LLC and the Plan Processer purchase insurance designed to provide compensation to harmed parties, up to pre-defined economically feasible limits."[44]

36. However, it is difficult to accept these claims given the lack of detail or empirical support. No details are given for what the "maximum extent" covers: does it cover direct damages (i.e., first-party damages to CAT LLC), or indirect costs (i.e., third party damages to Industry Members or the clients of Industry Members); does it cover the compromise of PII? There also is no elaboration on the costs of such insurance coverage, who the insurer is, or any details on how it was determined that additional coverage from other insurers is not available. Similarly, it is unclear what they consider to be the "economically feasible limit" of compensation for harmed parties or how such a limit was determined.

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[41] Metz, Jason, "Usage-Based Insurance Rewards Good Drivers," *Forbes*, updated December 10, 2020, available at https://www.forbes.com/advisor/car-insurance/usage-based-insurance/ (accessed on February 9, 2021).
[42] CRA Report, p. 36.
[43] Proposed Amendment, p. 15.
[44] CRA Report, pp. 35–36.

37. Regardless, if it is true that CAT LLC cannot purchase additional cyber insurance, this implies that Industry Members also cannot buy additional insurance coverage for the same risk exposures. Similarly, if the statement is meant to suggest that additional coverage does not exist at an "*economically feasible*" price, it is unclear why costs would be prohibitive to CAT LLC but not Industry Members. In fact, as discussed above, the costs of insurance to CAT LLC are likely to be lower than the combined cost of Industry Members purchasing an equivalent amount of coverage.

IV. Conclusion

38. This comment analyzes the economic issues underlying the Proposed Amendment to the CAT NMS Plan and responds to the economic analysis put forward in the CRA Report. As explained in this paper, my findings are that the Proposed Amendment, if adopted, would result in a reduction in investor welfare for two reasons: 1) investors would be at greater risk of having their data compromised since CAT LLC's incentives to invest in security to protect the CAT Data would be reduced, and 2) requiring Industry Members to absorb litigation-related expenses for an event which they have no direct control over will lead to the inefficient purchase of insurance with additional costs likely passed downstream to investors.

39. If the Proposed Amendment is not adopted and the CAT LLC was subject to potential litigation by Industry Members in addition to be being subject to regulation, this would help internalize all of the costs in the event of a breach or misuse of CAT Data. As a result, CAT LLC would be incentivized to invest in the socially optimal level of protection. Any insurance purchased by CAT LLC would also be more efficient as it has full access to the CAT System and can subject itself to monitoring by insurers, mitigating the issue of asymmetric information.

CRAIG M. LEWIS
Curriculum Vitae
December 29, 2020

Madison S. Wigginton Professor of Finance
Owen Graduate School of Management
Vanderbilt University
401 21st Avenue South
Nashville, TN 37203

CONTACT INFORMATION

E-Mail: craig.lewis@vanderbilt.edu
Telephone: 615-322-2626

EDUCATION

Ph.D., University of Wisconsin-Madison, Finance, August 1986.

M.S., University of Wisconsin-Madison, Finance, August 1982.

B.S., Ohio State University, Accounting, June 1978.

ACADEMIC EXPERIENCE

Madison S. Wigginton Professor of Finance, Owen Graduate School of Management, Vanderbilt University, Nashville, Tennessee, August 2007 – Present

Visiting Professor of Accounting, Bocconi University, Milan, Italy, 2017 - Present.

Professor of Law, Vanderbilt Law School, Vanderbilt University, Tennessee, December 2014 - Present

Professor of Finance, Owen Graduate School of Management, Vanderbilt University, Nashville, Tennessee, 2004 - 2007

Associate Professor of Management, Owen Graduate School of Management, Vanderbilt University, Nashville, Tennessee, 1993 - 2004

Visiting Professor of Finance, Donau Universität, Krems, Austria, 2001 - 2005

Visiting Professor of Derivatives and Financial Engineering, Johann Wolfgang Goethe-Universität, Frankfurt, Germany, Summer 2000

Visiting Professor of Finance, Amos Tuck School of Business, Dartmouth College, Hanover, New Hampshire, Spring 2000

Assistant Professor of Management, Owen Graduate School of Management, Vanderbilt University, Nashville, Tennessee, 1986 - 1993

Instructor, Graduate School of Business, University of Wisconsin-Madison, Madison, Wisconsin, Summers of 1983 - 1985

REGULATORY EXPERIENCE

Director of the Division of Economic and Risk Analysis, U.S. Securities and Exchange Commission, formerly named Division of Risk, Strategy, and Financial Innovation, June 2011 – May 2014

Chief Economist, U.S. Securities and Exchange Commission, June 2011 – May 2014

Vice Chairman, Committee on Emerging Risk, International Organization of Securities Commissions (IOSCO), July 2013 – May 2014

Economic Fellow, U.S. Securities and Exchange Commission, January 2010 – August 2010 and January 2011 – June 2011

PROFESSIONAL EXPERIENCE AND CERTIFICATION

Arthur Young and Company, 1978-1981

Patomak Global Partners, Senior Advisor, 2014 – Present

Passed Certified Public Accounting Exam in the State of Ohio

HONORS AND AWARDS

Financial Industry Regulatory Authority (FINRA) Economic Advisory Committee, 2017-- Present

Financial Executives Research Foundation, Research Committee, 2016 -- Present

Financial Economists Roundtable, 2015 -- Present

SEC Historical Society Museum Committee, 2016 -- Present

NACD Directorship 100: Governance Professionals and Institutions, 2011-2013

James A. Webb Award for Excellence in Teaching at the Owen Graduate School of Management, Vanderbilt University, 1991, 2000, 2009

Finalist for James A. Webb Award for Excellence in Teaching at the Owen Graduate School of Management, Vanderbilt University, 1997, 1999, 2001, 2010

Hirtle Callaghan Research Scholar Award, 2005

Dean's Research Productivity Award at the Owen Graduate School of Management, Vanderbilt University, 2003

NASDAQ Award for the Best Paper on Capital Formation at the Western Finance Association, June 2001 for "Busted IPOs and Windows of Misopportunity"

Fama-DFA Prize for the Best Paper Published in the *Journal of Financial Economics* in the Areas of Capital Markets and Asset Pricing, 2001, 1st Place for "Following the Leader: A Study of Individual Analysts Earnings Forecasts"

Dean's Award for Teaching Excellence at the Owen Graduate School of Management, Vanderbilt University, 1992, 1999

Outstanding Executive MBA Professor at the Owen Graduate School of Management, Vanderbilt University, 1991

DISSERTATION

"A Multiperiod Theory of Corporate Financial Policy with Taxation."
Dissertation Committee: Lemma Senbet (Chairman), Robert Haugen, William Brock, Werner DeBondt, and Theoharry Grammatikos

PUBLICATIONS

Lewis, Craig and Steven Young, "Fad or Future? Automated Analysis of Financial Text and its Implications for Corporate Reporting," *Accounting and Business Research* 49, (2019), 587-615.

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- 2015 Editor's Choice award.

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Charoenrook, Anchada and Craig M. Lewis, "Information and Selective Disclosure," *Financial Management*, 38:1 (2009), 39-58.

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- Fama-DFA Prize for the Best Paper Published in the *Journal of Financial Economics* in the Areas of Capital Markets and Asset Pricing, 2001

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- 1998 JFI Most Significant Paper Prize, runner-up.

Chaney, Paul K. and Craig M. Lewis, "Income Smoothing and Underperformance in Initial Public Offerings," *Journal of Corporate Finance*, 4 (1998), 1-29.

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Lewis, Craig M., "Liquid Alternative Mutual Funds: An Asset Class that Expands Opportunities for Diversification," March 2016.

Lewis, Craig M., "SolidX Bitcoin Trust: A Bitcoin Exchange Traded Product," February 2017.

Lewis, Craig M., "The Flawed Cost-Benefit Analysis Underlying the Department of Labor's Fiduciary Rule," August 2017.

Lewis, Craig M., "The Economics of Share Repurchase Programs," January 2019.

Lewis, Craig and Joshua T. White, "Science or Compliance: Will Section 404(b) Compliance Impede Innovation by Emerging Growth Companies in the Biotech Industry?" January 2019.

WORKING PAPERS

"Slow Moving Capital: Convertible Debt Arbitrage Crashes Revisited," formerly "The Cost of Liquidity Provision in Bond Markets During Periods of Market Stress, 2020, with Benjamin Munyan and Patrick Verwijmeren, first draft 2017.

"A Statistical Approach for Optimal Topic Model Identification," 2020 with Francesco Grossetti, first draft 2018.

"Is the Bottom Line the Top Priority: Revenue Versus Earnings Guidance," with Audra Boone, Austin Starkweather, and Josh White, February 2020, first draft 2019.

"Deregulating Innovation Capital: The Effects of the JOBS Act on Biotech Startups," 2020 with Josh White

"Changing Fundamentals Explain the Attenuation of Investment-Related Anomalies Better than Arbitrage," 2021, with Siukai Choy and Yongxian Tan

<u>INVITED PAPER PRESENTATIONS</u>

"A Multiperiod Theory of Corporate Financial Policy under Taxation," The Amos Tuck Graduate School of Business, Dartmouth College, February 1987, University of Arizona, February 1987, Columbia University, February 1987, Indiana University, January 1987, The University of Houston, February 1987, Vanderbilt University, March 1987, Western Finance Association meeting, June 1987, Harvard University, March 1989.

"The Behavior of the Volatility Implicit in the Prices of Stock Index Options," Western Finance Association meeting, June 1988 and the Amex Option Colloquium, December 1987.

"A Role for Recapitalization in Corporate Control Contests," The Amos Tuck Graduate School of Business, Dartmouth College, May 1988, TIMS meeting - Osaka, Japan, July 1989.

"Convertible Debt: Valuation and Conversion in Complex Capital Structures," Western Finance Association meeting, June 1989, Nanzan University, July 1989.

"Are Debt and Leases Substitutes?" University of Florida, May 1989.

"Earnings Management and Firm Valuation under Asymmetric Information," University of Utah, January 1990, ORSA/TIMS meeting, May 1990, Western Finance Association meeting, June 1991.

"Stock Market Volatility and the Information Content of Stock Index Options," Statistical Models for Financial Volatility Conference at the University of California-San Diego; April 1990, Association of Managerial Economists meeting, Washington, D.C., December 1990, The Wharton School, University of Pennsylvania, October 1991.

"Initial Margin Policy and Stochastic Volatility in the Crude Oil Futures Market," Winter Finance Conference at the University of Utah; February 1993.

"Agency Problems, Information Asymmetries, and Convertible Debt Security Design," NBER Conference on Corporate Finance, November 1994, American Finance Association meetings, December 1996.

"The Information Content of Value Line Convertible Bond Rankings," University of Utah, May 1995, The University of Virginia, May 1995.

"Margin Adequacy in Futures Markets," University of Illinois, November 1995, Virginia Tech, October 1996, University of Maryland, March 1997, Dartmouth College, October 1997.

"Is Convertible Debt a Substitute for Straight Debt or Common Equity?," University of Miami, November 1997, American Finance Association meetings, December 1998, European Financial Management Association meetings, June 1999.

"Following the Leader: A Study of Individual Analysts Earnings Forecasts," University of Wisconsin – Madison, November 1998, Conference on Corporate Earnings, April 1999, NBER Conference on Corporate Finance, August 1999, University of British Columbia, March 2000, Mannheim University, July 2000.

"The Long-Run Performance of Firms Adopting Compensation Plans Based on Economic Profits," Dartmouth College, May 2000, The Ohio State University, May 2000, Johann Wolfgang Goethe-Universität, June 2000, Financial Management Association meetings, October, 2000, The London Business School, October 2001.

"Busted IPOs and Windows of Misopportunity," Carnegie-Mellon, October 2000, Penn State University, April 2001, Western Finance Association meetings, June, 2001, Southern Methodist University, April 2002, University of Texas at Dallas, April 2002.

"The Determinants of Issue Cycles for Initial Public Offerings," University of Kentucky, October 2002, Babson College, February 2003, University of Oklahoma, December 2003, University of New Orleans, March 2004, University of Tubingen, June 2004, University of Freiberg, June 2004, Financial Management Association, Sienna, Italy, June 2005.

"Shareholder Initiated Class Action Lawsuits: Shareholder Wealth Effects and Industry Feedback," University of Kansas, October 2004, U.S. Securities and Exchange Commission, Washington, D.C., May 2005, Summer Finance Conference at University of British Columbia, Tofino, British Columbia, June 2005, Corporate Governance Conference, Washington University, November 2005.

"Firm-Specific Estimates of the Bankruptcy Discount Function," The University of Wisconsin – Madison, November 2008, U. S. Securities and Exchange Commission, February 2009, Financial Management Association, Torino, Italy, May 2009, University of New South Wales, March 2010, University of Melbourne, March 2010.

"Convertibles and Hedge Funds as Distributors of Equity Exposure" U.S. Securities and Exchange Commission, May 2010, University of Maryland, May 2010, American University, May 2010, U.S. Federal Reserve Board, June 2010, University of South Florida, October 2010, American Finance Association meetings, January 2011, George Mason University, September 2011, Norwegian Business School, Oslo, May 2012, Copenhagen Business School, Copenhagen, May 2012, Aalto Business School, Helsinki, May 2012

"The RSFI Money Market Fund Study," The University of Glasgow, Glasgow, Scotland, April 2013, H.E.C., Versailles, France, April 2013

"The Economic Implications of Money Market Fund Capital Buffers," CIRANO, November 2014, Montreal, Quebec, November 2014

"Do Fraudulent Firms Produce Abnormal Disclosure?," George Washington University, October 2013, Columbia University, October 2013, University of North Carolina at Chapel Hill, October 2013, Duke University, November 2013, London Business School, November 2013, London School of Economics, November 2013, University of Tennessee – Knoxville, November 2013, U.S. Department of Treasury, Office of Financial Research, March 2014, American Finance Association, Boston, Massachusetts, January 2015, University of Memphis, March 2015, University of Oklahoma, April 2015, Frankfurt School of Finance and Management, May 2015, Frankfurt, Germany, Bocconi University, June 2015, Goethe University, November 2015, Southern Economic Association, New Orleans, Louisiana, November 2015, Rice University, Houston, Texas, April 2016.

"The Cost of Liquidity Provision in Bond Markets During Periods of Market Stress," University of Washington, April 2017, Ca'Foscari University, May 2017, Bocconi University, June 2017, Erasmus University Rotterdam, May 2018, Financial Management Association, Kristianstand, Norway, May 2018.

"Is the Bottom Line the Top Priority: Revenue Versus Earnings Guidance," University of Wyoming, September 2019, Ole Miss, October 2019, Bocconi University, June 2010

INVITED PRESENTATIONS

The Effectiveness of Economic Value Added (EVA), Financial Management Association, Denver, Colorado, October 2003.

The Economics of Shareholder Litigation, Financial Management Association, Chicago, Illinois, October 2005.

Bridging Theory and Practice in Finance, Macroeconomics, and Regulation, Vanderbilt University Law School, Sept. 2011.

Securities Law Roundtable at Georgetown, Georgetown Law School, Washington, D.C., September 2011

Conference on Systemic Risk and Data Issues, Center for Financial Policy (University of Maryland), Salomon Center for the Study of Financial Institutions New York University), Center for Financial Markets (Carnegie Mellon University), and Fisher Center for Real Estate and Urban Economics (UC, Berkeley), Washington, D.C, October 2011

FIA Futures and Options Expo, Panelist on "Responding to Market Instability" and "Impact of High-Frequency Trading on Markets" sessions, Chicago, Illinois, October 2011

U.S. Securities and Exchange Commission, Advisory Committee on Small and Emerging Companies, Washington, D.C., October 2011

The Macroprudential Toolkit: Measurement and Analysis Conference sponsored by the Office of Financial Research, Moderator for "Risk Management?: What's the Frontier" session, Washington, DC, December 2011.

Columbia Funds Board of Directors Meeting, Washington, DC, December 2011

Mutual Fund Directors Forum, Board of Directors meeting, Washington, DC, January 2012

Zicklin-Capco Institute Paper Series in Applied Finance Conference, Panelist on Capital Adequacy and Basel III session, Baruch University, New York, New York, February 2012

Practicing Law Institute, SEC Speaks 2012 Conference, Washington, DC, February 2012

University of Wisconsin – Madison, Granger School of Business, Madison, WI, March 2012

Policy Roundtable on the Future of Financial Regulation, Monetary and Capital Markets Department, IMF and Center for Financial Policy, University of Maryland, April 2012

Policy Chat, Center for Financial Policy, University of Maryland, April 2012

Case Western Reserve University, April 2012

Risk Minds Conference, Keynote Speaker, "Quantitative Risk Assessment at the SEC," Boston, MA, June 2012, http://www.sec.gov/news/speech/2012/spch060512cml.htm

Financial Management Association, Panelist on "Market Structure: Perspectives of Regulators and Exchanges," Istanbul, Turkey, June 2012

Quant Congress USA, Keynote Speaker, "Quantitative Risk Assessment at the SEC," New York, NY, July 2012

Women in Housing and Finance Public Policy Luncheon, Key Note Speaker, "SEC priorities in Perspective," Washington, DC, August 2012

SIFMA Compliance & Legal Monthly Luncheon, Keynote Speaker, "The Expanded Role of Economists in SEC Rulemaking," New York, NY, October 2012, http://www.sec.gov/news/speech/2012/spch101612cml.htm

Risk Management in a Fast Changing Regulatory Environment, Rutgers University, Panelist on "Risk Management at Non-Banks," Newark, NJ, November 2012

Waters USA 2012, "Title VII and the Dodd Frank Act," keynote speech, New York, New York, December 2012

The Consortium for Systemic Risk Analytics, "Money Market Reform," keynote speech, M.I.T. University, Cambridge, MA, December 2012

BB&T Center for the Study of Capitalism, Wake Forest University, "Risk Assessment and the Role of Data Analytics at the SEC," Winston-Salem, North Carolina, February 2013.

National Association of Business Economists Conference on Global Challenges, Domestic Choices: Options for Economic Policy, "Money Fund Regulation," panelist, Washington, DC, March 2013.

The Investment Company Institute and the Federal Bar Association Mutual Funds & Investment Management Conference, "Money Market Funds: The Regulatory Hot Potato," panelist, Palm Desert, California, March 2013.

Institute for Data Sciences and Engineering, Columbia University, IDSE Seminar Series Event, "Analytic Accounting Risk Modeling at the SEC," New York, New York, March 2013.

XBRL International, "Analytic Accounting Risk Modeling at the SEC," keynote speech, Dublin, Ireland, April 2013

The Irish Banking Federation, "The RSFI Money Market Fund Study," keynote speech, Dublin, Ireland, April 2013

The ICI Money Market Fund Advisory Committee, "Money Market Funds," panelist, Washington, D.C., April 2013

Pennsylvania Association of Public Employee Retirement Systems Annual Spring Forum, "Investor Protection Through Economic Analysis," keynote speech, Harrisburg, Pennsylvania, May 2013, http://www.sec.gov/News/Speech/Detail/Speech/1365171575422

Journal of Business, Finance, and Accounting Capital Markets Conference, "Analytic Accounting Risk Modeling at the SEC," keynote speech, Chapel Hill, North Carolina, May 2013

Mid-Atlantic Enforcement Cooperative Conference, "Analytic Accounting Risk Modeling at the SEC," keynote speech, Philadelphia, Pennsylvania, June 2013

National Economists Club, "The Economics of Money Market Reform," keynote speech, Washington, DC, April 2013.

American Bar Association Annual Meeting, "The Money Market Fund Conundrum: Balancing Competing Regulatory Agendas with Investor Needs," Panelist, San Francisco, California, August 2013.

Data Transparency Coalition 2013, "Policy Spotlight: Financial Regulation," keynote speech, Washington, DC, September 2013.

XBRL USA Annual Meeting, "The Accounting Quality Model," keynote speech, Las Vegas, Nevada, September 2013

2013 Academic and Practitioner Conference on Mutual Funds and ETFs, ICI and University of Maryland, Risk Management and Oversight, panel moderator, October 2013, College Park, Maryland

Vanderbilt Conference on Institutional Investors and Price Efficiency, "Alternative Trading Systems," keynote speech, Nashville, Tennessee, October 2013

Practicing Law Institute, "Recent Developments in Rule Making," panelist, New York, New York, November 2013

Corporate Governance Center at University of Tennessee – Knoxville, "Risk Assessment at the SEC – The Accounting Quality Model," keynote speech, Knoxville, Tennessee, November 2013

AICPA Conference on Current SEC and PCAOB Developments, "The Role of Data Analysis in the Future of Financial Reporting," panelist, Washington, DC, December 2013.

The Consortium for Systemic Risk Analytics, "Risk Assessment – The Accounting Quality Model," keynote speech, M.I.T. University, Cambridge, MA, December 2013.

Practicing Law Institute, Corporate Governance – A Master Class, "Audit Committees Back in the Hot Seat," panelist, New York, New York, February 2014

Investment Company Institute 2014 Mutual Funds and Investment Management Conference, "Encouraging Economic Discourse," keynote speech, Orlando, Florida, March 2014, http://www.sec.gov/News/Speech/Detail/Speech/1370541172162#.U0FkidxBV8s

INQUIRE Europe and INQUIRE UK Spring Seminar, "The Economic Analysis of the Regulation of Money Market Funds," speaker, Vienna, Austria, March 2014

SIFMA Compliance and Legal Society Annual Seminar, "SEC Developments," panelist, Orlando, Florida, April 2014

International Forum of Independent Audit Regulators Plenary Meeting 2014, "Risk Assessment," panelist, Washington, DC, April 2014

University of Pennsylvania, Wharton School of Business, "Economic Analysis," Philadelphia, Pennsylvania, April 2014

Massachusetts Institute of Technology, Center for Financial Policy Distinguished Speaker Series, "The Future of Capital Formation," Boston, Massachusetts, April 2014

Financial Executives Institute 2014 Summit Leadership Conference, "Discretionary Disclosure Detection," keynote speaker, Washington, DC, June 2014.

Sustainable Architecture for Finance in Europe, "Money Market Reform," keynote speaker, Frankfurt, Germany, July 2014.

The Exchange Conference, "The Current State of XBRL," panelist, Orlando, Florida, September 2014.

The Southeastern Association of Shared Resources (SEASR) and the Midwest Association of Core Directors (MWACD) 2014 Conference, "Evaluating Core Impact," panelist, Nashville, Tennessee, October 2014.

Financial Management Association, "Hot Topics at the SEC," panel moderator, Nashville, Tennessee, October 2014.

New York Society of Certified Public Accountants, Public Company Accounting and Auditing Conference, "Data Analytics," keynote speech, New York, New York, October 2014.

SEC Historical Society, "The Experts Forum: FTI Consulting | Compass Lexecon, Dodd-Frank, Derivatives and Structured Finance," panel moderator, Washington, D.C., November 2014.

Certified Financial Analyst Society of Nashville, "Economic Analysis and Risk Assessment at the SEC," keynote speech, Nashville, Tennessee, November 2014.

CIRANO, "Central Banking and Supervision, What Have We Learned Since 2008 Conference," presenter, Montreal, Quebec, November 2014.

American Accounting Association, Financial Accounting and Reporting Section, Midyear Meeting, "The Accounting Quality Model," keynote speech, Nashville, Tennessee, January 2015.

Investment Company Institute/Boston University, Conference on Financial Stability and Asset Management, "The Role of Asset Management in Economic Growth and Financial Stability: Problem or Solution?," panel moderator, Boston, Massachusetts, March 2015.

Certified Financial Analyst Society of Memphis, "Economic Analysis and Risk Assessment at the SEC," keynote speech, Memphis, Tennessee, March 2015.

Data Transparency Coalition, Financial Regulation Summit, "International and Academic panel," panelist, Washington, D.C., March 2015.

Vanderbilt University Law School, 17th Annual Law and Business Conference Developing Areas of Capital Market and Federal Securities Regulation, "Capital Formation and the JOBS Act," panel moderator, March 2015, Nashville, Tennessee, March 2015.

University of Oklahoma, "Capital Formation and the JOBS Act," keynote speech, Norman, Oklahoma, April 2015.

The American Assembly, "The Role of the Securities and Exchange Commission in a Changing World, The Role of the SEC at Home and Abroad," panelist, May 2015, Washington, DC

Frankfurt School of Finance and Management, Perspectives in Auditing Conference, "The SEC's Accounting Quality Model," keynote speech, Frankfurt, Germany, May 2015.

ICI/University of Virginia Academic & Practitioner Conference on Mutual Funds and ETFs, "Bond Market Liquidity," panel moderator, October 2015.

Illinois Institute of Technology Conference on High Frequency Trading, "High Frequency Trading and Financial Regulation," keynote speech, November 2015.

SEC Historical Society, "The Experts Forum: FTI Consulting | Compass Lexecon, "The Impact of Falling Oil Prices on Financial Reporting," panel moderator, Washington, D.C., November 2015.

The Conference of Fund Leaders, Mutual Fund Directors Forum and the Millstein Center for Global Markets and Corporate Ownership at Columbia Law School, "Mutual Funds and Systemic Risk," speaker, New York, NY, May 2015

Financial Management Association, "Financial Regulation," panelist, Helsinki, Finland, June 2016

Family Office and Private Wealth Management Forum, "A Global Macroeconomic Outlook and Forecast: Looking at the 2016 Presidential Election and the Future of the Global Economy," panelist, Newport, RI, July 2016

CARE Conference, "Perspectives on Fraud," Co-Organizer, Leesburg, VA, August 2016

CARE Conference, "Viewpoint of Regulators," panel moderator, Co-Organizer, Leesburg, VA, August 2016

CARE Conference, "Models for Predicting and Detecting Fraud," panel moderator, Co-Organizer, Leesburg, VA, August 2016

Center for International Securities & Derivatives Markets Isenberg School of Management Conference, "Regulation & Liquidity Concerns in the Asset Management Industry," speech, Amherst, Massachusetts, October 2016.

SEC Historical Society, "The Experts Forum: FTI Consulting | Compass Lexecon, "Are CCPs too Big to Fail," panel moderator, Washington, D.C., November 2016.

Ernst & Young and Jones Day Accounting & Enforcement Innovation Summit, "Emerging Risks in Financial Reporting and Disclosures," panelist, Atlanta, Georgia, December 2016.

Owen Graduate School Alumni Luncheon, "Financial Regulation Outlook in the Post-Obama Era," Louisville, Kentucky, February 2017.

Opal Group's 2017 Investment Education Symposium, "Cooking the Books: A Regulatory Perspective," keynote speech, New Orleans, Louisiana, February 2017

Owen Graduate School Alumni Luncheon, "Data Analytics and Fraud Detection," Birmingham, Alabama, March 2017.

U.S. Securities and Exchange Commission, University of Maryland, and Lehigh University, Fourth Annual Conference of Financial Market Regulation, "SEC Research, "session chair, Washington, DC, May 2017.

David Lipscomb University's Updating the Professional Accountant Conference, "SEC: Risk Assessment and Fraud Detection," speech, Nashville, Tennessee, December 2017

Financial Management Association, Ph. D. Doctoral Consortium, Leader, Kristianstand, Norway, May 2018.

Bass, Berry, and Sims, Compliance & Government Investigations Seminar, SEC Enforcement Actions – Latest Developments and Practical Tips, panelist, Nashville, Tennessee, September 2018.

2018 Workiva Users Conference, Expert Panel: XBRL Matters and How XBRL Is Consumed, panelist, Nashville, Tennessee, September 2018.

Financial Management Association, Jack Rader Breakfast, keynote speech, "Text Analytics in Financial Research," San Diego, California, October 2018.

2018 ICAEW PD Leake lecture, keynote speech, "More Than Words: The Use of Textual Analysis in Corporate Reporting," London, England, November 2018, https://www.icaew.com/technical/financial-reporting/information-for-better-markets/more-than-words.

14th INQUIRE UK Business School Seminar organized with University College London, keynote speech, "Textual Analysis Can Be Fundamental," London, England, June 2019.

House Financial Services Subcommittee on Investor Protection, Entrepreneurship, and Capital Markets Hearing, "Examining Corporate Priorities: The Impact of Stock Buybacks on Workers, Communities, and Investors," witness, Washington, D.C., October 17, 2019.

Opal Group/LATEC Investment Education Symposium, "A Macroeconomic Outlook: State of the US Retirement System and Future Forecast," panelist, February 2020.

Expert Forum BVI and ICI, The Management of Liquidity and Leverage Risk in Regulated Funds, "A Close-up Look at Open-End Fund Use of Leverage and Derivatives," panelist, Frankfurt, Germany, March 2020.

Georgetown University, Center for Financial Markets and Policy, "Georgetown Webinar: Should Financial Markets be Closed?" panelist, March 2020.

U.S. Securities and Exchange Commission, "Automated Analysis of Financial Text and Its Implications for Corporate Reporting," invited presentation, SEC Quant Seminar, September 2020, virtual presentation.

RESEARCH GRANTS

Visiting Scholar Grant, Johann Wolfgang Goethe-Universität, Summer 2000

State Street Global Advisors, "Market Responsiveness to Earnings Forecasts," 1996, 1997, 1998.

New York Mercantile Exchange, "Forecasting Conditional Volatility in The Oil Futures Market with Option Prices," 1991.

Chicago Board Options Exchange, "The Behavior of Volatility Implicit in the Prices of Stock Index Options," 1987.

COURSES TAUGHT

Advanced Corporate Finance (MBA), Corporate Value Management (MBA, EMBA), Corporate Financial Policy (MBA, EMBA, Ph.D.), Derivative Securities (MBA), Advanced Derivatives Securities (MBA), Executive Managerial Finance I (MBA), Financial Economics Seminar (Ph.D.), Life Cycle of the Firm (MBA/JD), Managerial Finance (Undergraduate, MBA), Option Pricing (Undergraduate), Quantitative Portfolio Management (MBA), Empirical Methods in Corporate Finance (Ph.D.), Seminar in Venture Capital (Ph.D.), Seminar in Dynamic Capital Structure (Ph.D.)

EDITORIAL BOARDS AND OTHER ACADEMIC SERVICE

Journal of Business Accounting and Finance

Editorial Board, 2008 – 2019

Editor, 2019-prsesent

Journal of Risk and Financial Management, Editorial Board, 2020 - Present

Journal of Corporate Finance, Associate Editor, 2001 – 2020.

The North-American Journal of Economics and Finance, Associate Editor, 2010 – Present

The Journal of Financial Research, Associate Editor, 1999 – 2006

Financial Management Association, Practitioner Director, 2015 - 2018

REFEREEING

Professional Journals:

Journal of Financial Economics, Journal of Finance, Review of Financial Studies, Journal of Econometrics, Journal of Financial and Quantitative Analysis, Journal of Financial Intermediation, Financial Management, Journal of Financial Research, Journal of Corporate Finance, Journal of Derivatives, Journal of Empirical Finance, Management Science, Journal of Futures Markets, Journal of Banking and Finance, Journal of Business, Finance and Accounting, International Review of Financial Analysis, Review of Derivatives Research, Review of Financial Economics, The Financial Review, Quarterly Review of Economics and Business, Review of Futures Markets

Program Committees:

Western Finance Association meetings, 1989 and 1992
Financial Management Association, 1990, 1992, 1993, 2004
FMA Competitive Paper Awards Committee, 1996, 2000,2016.

Chairman, FMA Competitive Paper Awards Committee, 2005.
Chairman, FMA, Special Topics Section, 2006.
Co-Chairman, European Financial Management Association meeting, 2009
Chairman, Doctoral Student Consortium, European Financial Management Association meeting, 2015 and 2018
Financial Management Association, Program Committee, Napa Conference, 2017, 2018

ACADEMIC SERVICE

Open Rank Accounting Search Committee (1994)
Open Rank Finance Search Committee (1986, 1987 (Chair),1988, 1989, 1992, 1996, 1997, 1999, 2001, 2016)
Senior Level Faculty Search Committee (1987, 1988, 1989, 2000, 2007, 2008, 2009, 2016 (Chairman))
Ph.D. Committee (1987, 1988, 1989, 1990)
Facilities Planning Committee (1990)
Honors and Awards Committee (1991, 1992)
New Position Description Committee (1993)
Committee on Computing/Telecommunications Planning (1993, 1994)
Executive MBA Oversight Committee (1994, 2004)
Accounting Search Committee (1994)
SACS Compliance Audit Committee (1994)
Committee on Instruction (1995, 1996, 1997)
Computer Camp Planning Group (1996)
Building Committee (1996, 1997)
Statistics Camp Planning Group (1997)
Undergraduate Business Major Committee (1997)
Renewal and tenure review committees (1995, 1996, 1997, 1999, 2001-2006, 2009)
Core Curriculum Review Committee (2002, 2004, 2005)
Research Committee (2002, 2003, 2004, 2005)
Co-Director of the Law and Business Program (2002, 2003)
LEAD program committee (2004)
Owen Graduate School of Management, Executive Committee (2004, 2005, 2006)
Future of Undergraduate Business Education Committee (2005)
Executive M.B.A. Committee (2004, 2005, 2006, 2008, 2009, 2010, 2017-2020)
Distance Education Committee (2006)
M.B.A. Program Committee (2010, 2011)
Non-Degree Program Committee (2016-2020)
Data Science Visions Committee (2017)

THESIS COMMITEES

Mahmud Hassan (1987, Economics, University of Alabama at Birmingham), Paul Laux (1988, Economics, University of Texas at Austin), Rick Cooper (1990, Finance, Wayne State University), Vijay Chopra (1990, Finance, Frank Russell and Company), L. Shivakumar (1996, Finance, London Business School), C. Sinha (1997, Finance, General Electric Credit Corporation), Mary Watson (1997, Organizational Studies, University of North Carolina at Chapel Hill), Yi Zhang (2000, Economics, State Street Global Advisors), Hans Heidle (2001, Finance, Notre Dame), Saadet Kasman (2001, Economics), Xi Li (2002, Finance, University of Miami), Ingrid Fulmer (2003, Organizational Studies, Michigan State University), Yuanhe Yao (2003, Ec onomics), Sunhee Lee (2003, Economics), Jiaren Pang (2004, Economics), Jun Zhang, economics (2004, Economics, Chinese University of Hong Kong, Economics), Raj Nahata (2004, Finance, Baruch University), Vladimir Ivanov (2004, Finance, Dissertation Chairman, University of Kansas), Fei Xie (2005, San Diego State University), Veronika Krepely (2005, Finance, Indiana University), Gemma Lee (2005, Finance, University of Alabama), Cong Wang (2006, Finance, University of Hong Kong), Shawn Mobbs (2007, Finance, University of Alabama), Chih-Wei Wang (2008, Economics), Suk-Won Kim (2009, University of California, Riverside), Lixiong Gao (Finance, 2011, University of New South Wales), Yongxian Tan (Finance, Dissertation chairman, Shanghai University of Finance and Economics), Shage Zhang (Finance, Dissertation co-chairman, Trinity University), Siraj Bawa (2016, Economics, US Department of Agriculture), Jason Campbell (2018, Economics, University of San Diego)

CONSULTING

Allstate Corporation, Ameriprise, AQR, Ares Management, Association of Mature American Citizens, Bank of California, Berwind Industries, Biotechnology Innovation Organization, Booz, Allen, & Hamilton, BMW, Calloway Gardens, Chicago Board Options Exchange, Chicago Board of Trade, Chicago Tribune, Commerzbank, Core Civic, CTN Strategic Investments, CTS Strategic Investments, Center for Responsible Investing, DTTC, Dollar General Stores, Federal Trade Commission, First American Bank, Global Star, Hanseatic Marine, Harris Bank, J.C. Bradford & Co., Lipper Convertible Bond Fund, NationsBank, New York Mercantile Exchange, Options Clearing Corporation, Precidian Investments, Primerica, Pro Shares, Robinhood, Ronin Capital, RPM, SeaWorld, SolidX, State Street Global Advisors, Sovereign Energy Risk Management, Susquehanna Investment Group, TML Risk Management, Tribune Media Company, Tennessee Valley Authority, Tesla, UBS, Union Pacific Railroad, U.S. Securities and Exchange Commission, U.S. Treasury - Office of Financial Research, Wells Fargo, Western Sizzlin'