Investors' Judgment and Decisions after a Cybersecurity Breach: Understanding the Value Relevance of Cybersecurity Risk Management Assurance

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ABSTRACT

This study investigates how voluntary cybersecurity risk management (CRM) assurance affects non-professional investors' judgments and decisions. The study also examines how the value relevance of CRM assurance is altered when such assurance violates/conforms to users' expectations. We predict and find that companies that engage in voluntary CRM assurance receive higher stock price valuations and more favorable investor assessments of management credibility. Moreover, we find that investors' assessments of management credibility and stock price valuations are more extreme in the presence of positive and negative expectancy violations. Additional analysis reveals that investors' perceived benefits of assurance-as-insurance and perceived accountants' cyber-expertise are important determinants of investors' decision behavior. Further analysis also sheds light on the benefits and potential penalties associated with a firm's in-house CRM practices. The results have implications for regulators, accounting professionals, and market participants. This study also adds to the literature and theory exploring the value relevance of voluntary assurance.

Keywords: cybersecurity, cyber-risk management, voluntary assurance, investors' judgments and decisions

JEL Classifications: G11, G32, M42

I. INTRODUCTION

Cyber-breaches have drawn increased scrutiny due to their increasing frequency and magnitude of occurrence, and the associated financial impact on companies and investors. In response to these concerns, the American Institute of Certified Public Accountants (AICPA) is proposing new voluntary assurance services to address the information needs of users regarding company's cybersecurity activities and aiming to standardize associated reporting frameworks. Because use of the proposed services and the associated framework developed by the AICPA is voluntary, organizations' decision to engage in cybersecurity risk management assurance (CRM) is primarily risk-based. The AICPA acknowledges that it is the organization and its stakeholders who would drive the adoption of these services (AICPA 2017a). Prior research suggests that companies' underinvestment in cybersecurity may be a result of limited evidence regarding the benefits of such investments (Gordon, Loeb, Lycyshyn, Zhou 2015). Consequently, this study answers a call for research by the AICPA (AAA 2017) to better understand the cost of cyber-security breaches, users' associated information needs, and how and why CRM assurance may be feasible and desirable for an organization.

The purpose of this study is twofold. First, we examine whether knowledge about a firm's engagement in voluntary CRM assurance, prior to a cyber-breach, affects non-professional investors' judgments and decisions, after the breach. Second, we investigate whether the changes in investors' judgments and decisions differ in magnitude depending on whether CRM assurance violates or conforms to industry norms. Although prior accounting research that explore the benefits of voluntary assurance document greater stock price assessments (Brown-Liburd and Zamora 2014) and lower cost of capital (Dhaliwal, Zhen Li, Tsang, and Yang 2011), some studies suggest that the benefits of assurance are context specific

and are only significant when the assured information is positive (Coram, Monroe, and Woodliff 2009) and relevant to the company (Cheng, Green, and Chi Wa Ko 2015). Thus, the value relevance of voluntary assurance in the context of cybersecurity is a very different proposition given that cyber-breaches, to some degree, are believed to be unavoidable. As such, we aim to explore whether the benefits of voluntary assurance hold in the context of CRM assurance when assurance fails to prevent liability. Moreover, in contrast with recent research that explores the effect of joint or separate provisioning of CRM assurance and cyber-breaches on investors' willingness to invest (Perols and Murthy 2018), we take a step back and assess the value relevance of voluntary CRM assurance in isolation by exploring investors' decision behavior given the presence or absence of assurance in light of market expectations.

The theoretical underpinnings for this study are drawn from Wallace's (1980) work on the economic demand for audits in free markets and the associated Insurance Hypothesis. The Insurance Hypothesis posits that the demand for audit services is driven by their use as a tool to manage a company's liability exposure. Drawing on the Insurance Hypothesis, we predict that CRM assurance is positively associated with investors' valuation judgments. Moreover, consistent with prior studies on investor judgment and decision making, we also predict that assessments of management credibility mediate the effects of CRM assurance on investors' valuation judgments.

A fundamental aspect affecting the value of assurance that is not captured in the voluntary assurance literature is the market expectations for assurance which may differ based on industry norms or other such characteristics creating expectations. Thus, we draw on Expectancy Violations Theory (EVT) in predicting that the relationship between CRM assurance and assessments of management credibility will be stronger when expectations of a company

engaging in assurance services are violated (do not conform to industry norms). Specifically, we predict that investors' assessments of management credibility will be more favorable for companies that engage in voluntary CRM assurance and are not expected to do so compared to companies that engage in voluntary CRM assurance as expected. In contrast, investors' assessments of management credibility will be less favorable for companies that do not engage in voluntary assurance and are expected to do so compared to companies that do not engage in voluntary assurance, but for which this is the norm.

We test the predictions using a 2 x 2 between-subjects experiment in which participants are required to make valuation judgments and to assess the credibility of management after a cyber-breach. The independent variables of interest are the presence or absence of CRM assurance and the expectancies regarding whether the company should engage in CRM assurance. Specifically, the presence of assurance is manipulated by informing participants that the company has a CRM program in place and operating effectively, and that the company engaged in voluntary assurance over their CRM program and received a clean opinion from the auditors. In contrast, participants in the no-assurance condition are informed that, although the company has not engaged in assurance over their CRM program, the company has a CRM program in place and operating effectively.[1] Moreover, the expectation on whether the company should engage in CRM assurance is operationalized by informing participants that engagement in CRM assurance is expected or not expected based on the behavior of other companies in the same industry. To test the predictions, participants assess the company's stock price value and management's competence and trustworthiness (the two components of management credibility

[1] This design is chosen after examining the trend of current cyber-breach disclosures. We noted that companies usually disclose that they have controls in place and operating effectively.

documented in prior research (e.g., Clor-Proell 2009; Mercer 2004; Mercer 2005; Rennekamp 2012)).

Consistent with the predictions, we find that voluntary CRM assurance, prior to the occurrence of a cyber-breach, results in more favorable investor valuation judgments after a cyber-breach is disclosed. We also find that this relation is mediated by management credibility assessments. The results also support the predicted moderated mediation and provide evidence that the indirect effect of assurance on valuation judgments, through assessments of management credibility, is conditional on whether firms' practices violate or conform-to-expectancies.

Additional analyses explore how investors' perceived benefits of assurance-as-insurance (AAI) and perceived accountants' cyber-expertise (ACE) impact investors' decision behavior. We find that the direct effect of CRM assurance is associated with higher valuation judgments only when users perceived higher benefits of AAI. Moreover, we find that expectancy violations only influence decision behavior for participants that perceived higher accountants' cyber-expertise. Using additional data collected to explore the impact of disclosure of companies' cyber-risk management practices, we find that investors reward (penalize) companies with (without) formal CRM programs in place.

This study has several relevant practical implications. The AICPA is promoting the use of the Trust Services Framework and Criteria, which was recently updated to address cyber-risk management, and is encouraging accounting professionals to use this framework to provide voluntary assurance over CRM. However, prior efforts in promoting similar voluntary assurance services, such as the WebTrust seal of assurance, have largely failed or as in the case of SysTrust morphed into primarily internal services for management (i.e., SOC II reports). As such, a more in-depth understanding of the potential reaction by investors to new assurance services over an

entity's cybersecurity activities is timely in providing additional evidence to the AICPA that may assist in maximizing the benefit of their cybersecurity initiatives. Moreover, the results of this study provide evidence of the perceived value of CRM assurance and shed light on the need for and benefit of such assurance. This evidence informs regulators (such as the SEC) and financial statement stakeholders, trying to promote further disclosure and assurance over companies' cyber-risk practices (AAA 2017; AICPA 2017a; Cohn 2018). The findings of the study suggest that organizations' stakeholders may be able to drive the demand for voluntary CRM assurance, particularly if voluntary CRM assurance becomes expected for specific industries. As such, to create the demand that justifies the cost of voluntary CRM assurance the profession may need to effectively market and promote SOC II and III CRM assurance services.

This study contributes to the literature on investor judgment and decision making. Specifically, this study addresses investors' judgments and decisions after cyber-breaches and adds context to the archival literature on cybersecurity events by aiding in understanding the underlying drivers behind investors decision-making. For instance, this study provides evidence that, in general, market participants value voluntary CRM assurance-as-insurance but the extent of the impact of CRM assurance depends on investors' perceived benefits of assurance-as-insurance and perceived cyber-expertise of auditors. Moreover, although prior research addresses investors' reactions to other types of negative news, these studies generally limit their focus to disclosures of negative financial performance (e.g., bad earnings news). In contrast, using the context of non-financial disclosures (such as cyber-breaches) sheds light on the factors likely driving market reaction towards other types of negative events and disasters.

We also add to the literature and theory that documents the demand for voluntary assurance (Wallace 1980). This study contributes to theory by examining Wallace's (1980)

insurance hypothesis within the investor JDM context. The context of this study enables testing of the insurance hypothesis and supports this theorized explanation of the demand for voluntary assurance in high litigation risk settings. Moreover, this study further contributes to theory by integrating EVT into the theoretical model underlying the insurance hypothesis. The theoretical model developed in this study highlight the role of market expectancies, based on industry norms, in explaining the magnitude of demand for voluntary assurance

The remainder of the paper proceeds as follows. The next section provides background and explains the theoretical motivations driving the predictions. Section III discuss the methods by providing a description of the participants, the task, and the main variables in the analysis. Section IV discusses the results of the hypotheses, and additional analysis and Section V concludes.

II. BACKGROUND, THEORY, AND HYPOTHESIS

Assurance over information security

The Sarbanes-Oxley Act (SOX) act of 2002 requires management of public companies to assess the effectiveness of internal controls and requires auditors, under SOX section 404, to attest on management's assessment of internal controls (US 2002). Auditing Standard No. 5 (AS5) provides guidance for auditors to conduct an audit of management's assessment of the effectiveness of internal controls over financial reporting (ICFR) and establishes that, as part of the audit of internal controls, auditors should understand and evaluate the effectiveness of information technology general controls (PCAOB 2007). Accordingly, in connection with the audit of a company's ICFR, auditors are required to understand and evaluate controls over information security, such as controls to ensure that logical access to critical applications is restricted to only authorized users. Although there is an overlap between information security

and cybersecurity controls, the scope of an audit of internal control is limited to controls relevant to financial reporting, as required by AS5, regardless of whether an application beyond the scope of the audit hosts critical data that could be the target of a cyber-breach.

Recent initiatives are being promoted to standardize the disclosure of companies' cybersecurity risk management and controls. For instance, early in 2017, the AICPA released an updated edition of the Trust Services Principles and Criteria (TSPC) and a newly developed cybersecurity risk management reporting framework. The TSPC was revised to better address an organization's cybersecurity risks and to align the prior version of the TSPC with the Committee of Sponsoring Organizations of the Treadway Commission's (COSO's) Internal Control Framework updated in 2013. The TSPC provides a mechanism for CPAs interested in performing attestation over the security, availability, processing integrity, confidentiality, and privacy of information systems in an organization.[2]

The cybersecurity risk management reporting framework was developed by the AICPA as a means for communicating relevant information about a company's cyber-risk management practices to stakeholders. CPAs are expected to use the framework to evaluate an organization's cyber-risk management practices and to report on the effectiveness of controls. The ultimate goal of this initiative is to promote the use of a uniform reporting framework and to increase stakeholders' confidence in a company's cybersecurity disclosures. In particular, the AICPA is promoting the use of a system and organization control (SOC) reporting framework for cybersecurity (AICPA 2017a). A SOC is an examination engagement that should be performed in accordance with AICPA attestation standards. The use of this reporting framework provides a

[2] More details of the AICPA cybersecurity initiative, the revised Trust Services Principles and Criteria, and the SOC over cybersecurity is provided at the AICPA's cybersecurity resource center. http://www.aicpa.org/InterestAreas/FRC/AssuranceAdvisoryServices/Pages/cyber-security-resource-center.aspx

uniform set of criteria for disclosure and the assessment of the effectiveness of a company's cyber-risk management practices. According to the AICPA (2017a), this reporting framework is meant to be voluntary and flexible to be suitable for organizations of varying sizes and industries. The AICPA is also developing other CRM assurance products, such as a SOC for cybersecurity specific for vendor supply chains (AICPA 2017b).

Despite the development of a new assurance framework to specifically focus on cybersecurity risks, it is not the first time that the accounting profession has tried to address concerns about the security, availability, processing integrity, confidentiality, and privacy of information systems. During the late 1990s and early 2000s, the AICPA and the Canadian Institute of Charter Accountants (CICA) developed SysTrust and WebTrust, which are a set of principles and criteria to assure the reliability of information systems and e-commerce transactions, respectively (Gendron and Barrett 2004). In contrast with current motivations associated with the increased incidence and magnitude of cyber-breaches, the development of SysTrust and WebTrust was motivated by the demand for assurance services to address system reliability (McPhie 2000) and the emergence of the internet and online transactions (Barett and Gendron 2006). SysTrust was initially designed to provide assurance over systems that support business activities and to focus specifically on the principles of availability, security, integrity, and maintainability (McPhie 2000). In contrast, WebTrust was developed to specifically address electronic commerce transactions and to focus on the principles of security, availability, business practices, and transaction integrity (Elliott 2002). The SysTrust and WebTrust principles and criteria were later merged into a single framework, the Trust Services Principles, and Criteria. This framework evolved into a more comprehensive framework that covers the principles of

security, availability, processing integrity, confidentiality, and privacy and it is currently used by auditors to issue SOC 2 and SOC 3 reports.[3]

The development of web assurance services, in particular, the WebTrust seal, motivated early research on voluntary third-party assurance.[4] Overall, researchers found that web assurance positively influenced consumers intentions to purchase online (Kovar, Burke, and Kovar 2000; Kaplan and Nieschwietz 2003) and that consumers could differentiate the quality of web assurance seals (Lala, Arnold, Sutton, and Guan 2002). Although these initial findings seem to suggest that consumers valued third-party assurance, subsequent research failed to support the notion that external assurance results in incremental benefits for consumers. Specifically, Mauldin and Arunachalam (2002) found that web assurance is only associated with higher intentions to purchase when consumers do not observe disclosures about internal assurance and are less familiar with the product. Bahmanziari, Odom, and Ugrin (2009) extended these findings, showing that external web assurance did not impact consumers' trust or purchase intentions, neither on its own nor when interacting with internal assurance activities.

Although WebTrust was initially expected to be successful (Elliot 2002), the rate of companies engaging in web assurance was lower than expected (Barrett and Gendron 2006). This triggered intrigue regarding the profession's behavior and researchers in accounting began to study WebTrust through the lenses of the professionalization of accounting (Gendron and Barrett 2004; Barett and Gendron 2006) and managerial decision-making (Boulianne and Cho 2009) to further develop an understanding of the factors that contributed to the development,

[3] There are three types of SOC reports. SOC 1 reports are used by auditors to provide assurance over internal controls over financial reporting (ICFR) to user organizations. In contrast, SOC 2 and SOC 3 are used to provide assurance over, all or any combination of, the Trust Services framework principles. The difference between the SOC 2 and SOC 3 reports is that SOC 2 reports are for restrictive use while SOC 3 reports are intended to meet the needs of users who desire assurance on the controls of a service organization but do not have the need of a SOC 2 report. (Singleton 2011).

[4] Companies that received an unmodified opinion in their WebTrust report were allowed to display the WebTrust seal on their websites.

adoption, and, eventually, the perceived failure of the WebTrust seal of assurance. By conducting field study research, Gendron and Barrett (2004) found that accountants perceived that organizations were skeptical about the potential of WebTrust to provide additional comfort and increase consumers trust. This finding was mainly attributed to the existence of competing products sponsored by large technology organizations and available at a lower cost. Further evidence revealed that the profession failed to properly allocate marketing resources to promote their proposed web assurance service and companies perceived that the benefits were not sufficient to justify the necessary marketing cost (Boulianne and Cho 2009). Other researchers questioned whether the accounting profession was misguided to focus on assurance targeted to individual consumers (Sutton and Hampton 2003) and argued for a focus on business-to-business and supply chain related activities where accounting professionals had reputational advantages (Khazanchi and Sutton 2001; Sutton and Hampton 2003). The challenges faced by the accounting profession in establishing a reputation and demand for web assurance resulted in the transformation of WebTrust into a set of principles and criteria (in particular, first used together with SysTrust and eventually merged with SysTrust into a single framework, the Trust Services principles and criteria) to be used for advisory and business-to-business assurance services (Gendron and Barrett 2004; Barret and Gendron 2006).

Theoretical model

The theoretical model in this study is based on Wallace's (1980) Insurance Hypothesis and EVT ((Burgoon and Hale 1988; Burgoon 1993). The insurance hypothesis addresses why organizations may desire assurance irrespective of regulatory demands and provides a conceptual foundation for exploring sources of the demand for voluntary assurance over cybersecurity. The Insurance Hypothesis particularly argues that users value and demand voluntary assurance as an

alternative to traditional insurance products used to control for litigation risk. As illustrated in Figure 1, the model predicts that CRM assurance is positively associated with investors' valuation judgments and that this relation is mediated by investors' perceptions of management credibility. Then, drawing on EVT, we propose that expectancies should influence the strength of the demand modeled in the Insurance Hypothesis. In particular, we predict that expectancies of assurance will alter the strength of the relationship between voluntary assurance and perceived management credibility, which flows through to impact investors' valuation judgments. The theoretical model presented in this study incorporates these considerations to better explain why investors might expect a company to engage in such services and how these expectancies alter investors' assessments of management credibility and related valuation judgments.

~ Insert Figure 1 about here ~

Voluntary assurance and the insurance hypothesis

Wallace (1980) explains the reasonableness behind using assurance services as insurance, relative or as a complement of using traditional insurance policies with four main arguments. First, the perceived need for auditors to substantiate professional care, which may be beneficial to argue against allegations of negligence in a litigation setting. These effects should also carry over to other company stakeholders that may have concerns related to perceptions of due care. Second, Wallace highlights how clients benefit from the auditors' sophisticated legal expertise which allows the use of the auditor as a powerful codefendant. Third, the client and auditor's shared interest and concern about their reputations ensures proper consideration of the impact of litigation. Last, Wallace argues that by engaging in assurance services companies can shift a portion of the blame and liability toward the auditor, as auditors are generally perceived as the guarantors of the accuracy of audited financial and non-financial information.

Findings from prior research show that voluntary assurance results in higher stock price assessments (Brown-Liburd and Zamora 2014) and lower cost of capital (Dhaliwal et al. 2011). In contrast, other research documents that the benefits of assurance are context specific. For instance, Coram et al. (2009) find that assurance of non-financial performance indicators influence stock price estimates only when presenting positive indicators and Cheng et al. (2015) find that assurance of sustainability indicators increase willingness to invest when assured information is relevant to the company. We argue that the demand for CRM assurance, in the context of this study, is primarily motivated by Wallace's (1980) Insurance Hypothesis as among the main concerns regarding cyber-breaches are the litigation risks, company reputation, and the associated costs.[5]

In developing the baseline expectations, we consider the arguments that justify the use of voluntary assurance to mitigate potential legal damages and prior findings on the positive impact of voluntary assurance. As such, theoretically, companies that report a cyber-breach, but have previously engaged in voluntary CRM assurance, should receive less negative investors' valuation judgments. This leads to the first hypothesis:

> **H1:** Voluntary CRM assurance (no-assurance), prior to the occurrence of a cyber-breach, will result in less negative (more negative) investor valuation judgments after the disclosure of a cyber-breach.

Voluntary assurance and management credibility

Findings from prior research suggest that companies engage in voluntary assurance services, mainly, to enhance their credibility and reputation (Simnett, Vanstraelen, and Chua

[5] We argue about the Insurance Hypothesis as the more likely source of demand for cybersecurity assurance considering the nature of cybersecurity threats. In particular, given the sophistication of cyber-breaches, companies may be unable to reduce the risk and potential loss associated with a cyber-breach through the implementation of internal controls alone. As such, the use of cybersecurity insurance is a likely resource that firms can use to share their cyber-risk, either as an alternative or complement to other potential controls to reduce or avoid cyber-risks. Besides, we expect that the information regarding the presence or absence of assurance after a cyber-breach will impact investors' judgments as the expected future loss will be lower given the use of assurance as insurance.

2009). For instance, Pflugrath, Roebuck, and Simnett (2011) find that assurance increased the credibility of CSR reports. We predict that management engagement in CRM assurance will result in more favorable assessments of management credibility, after the disclosure of a cyber-breach, given two main reasons: 1) prior research establishes that audited disclosures are more credible than unaudited disclosures (e.g., Brown-Liburd and Zamora 2014; Dhaliwal et al. 2011; Mercer 2004), and 2) the benefits of using CRM assurance-as-insurance may lead to more favorable assessments of management competence given investors beliefs that management's decisions are in their best interest. Moreover, we predict that management credibility assessments will, in turn, impact valuation judgments. These arguments lead to the following hypotheses:

> **H2a:** Voluntary CRM assurance (no-assurance), before the occurrence of a cyber-breach, will result in less negative (more negative) investors' assessment of management credibility after the disclosure of a cyber-breach.
> **H2b:** Assessments of management credibility mediate the effects of CRM assurance on investors' valuation judgments.

Expectancy Violations Theory

Another aspect relevant to understanding the demand for CRM assurance is whether investors take into consideration the consensus use of such services (whether assurance is expected or not expected) by peer companies within the same industry. Prior research suggests that investors' evaluation of a company depends on whether the company's accounting choices conform to the industry norms (Clor-Proell 2009; Koonce, Miller, and Winchel 2015). Moreover, Mercer (2004, 192) argues that *"a disclosure that deviates significantly from investors' expectations will be less credible than one that does not."* This effect is conceptualized in expectancy violations theory (EVT) (Burgoon and Hale 1988; Burgoon 1993) which provides a

theoretical basis for understanding why voluntary CRM assurance would have similar effects when engaging in such assurance services is considered an industry norm.

EVT establishes that individuals develop expectancies to assess communication outcomes and that these expectancies are influenced by the communicator characteristics, relationship factors, and context characteristics (Burgoon and Hale 1988; Burgoon 1993). Expectancies are violated when the communication outcomes are not in conformity with expectations or preferences about social norms and known idiosyncrasies (Burgoon and Hale 1988). EVT posits that the impact of a violation depends on the violation valence, such that positive violations produce favorable communication consequences while negative violations are detrimental compared to outcomes that conform-to-expectancies. As such, it is expected that the arousal that is triggered by the violation results in an intensification of evaluations of the communicators.

As such, consistent with EVT, we predict that violation of expectancies will result in more extreme assessments of management credibility (see Figure 1, Panel B for predictions), such that positive violations (presence of assurance when it is not expected) result in more extreme positive assessments of management credibility and negative violations (absence of assurance when assurance is expected) result in more extreme negative assessments of management credibility. Moreover, we predict that investors' assessments of management credibility, based on whether the company violates or conforms to the expectations, will mediate the relationship between the presence (absence) of assurance and investor's assessments of future stock prices. This leads to the third set of hypotheses (as illustrated in Figure 1):

> **H3a:** The effect of CRM assurance on users' assessment of management credibility is more extreme in the presence of expectancy violations.
> **H3b:** Assessments of management credibility mediate the expectancies moderated effects of CRM assurance on investors' valuation judgments.

III. METHODS

To test the research model, we use a 2 x 2 experimental design in which assurance (assurance versus no-assurance) and investors' expectations of the presence of assurance (violate-expectancies versus conform-to-expectancies) are manipulated between-participants. A sample of non-professional investors are recruited to complete the experimental case in order to observe decision behavior. The focus of the experimental study is on how investor decision making changes in light of the presence or absence of assurance based on when company practices violate or conform-to-expectancies.

Participants

Participants are 168 individuals recruited through Amazon Mechanical Turk (MTurk) in exchange for either $1.00 or $2.50, based on their qualifications.[6] [7] Participation is limited to MTurk workers that have completed at least 500 Human Intelligence Tasks (HITs) and with at least a 95 percent approval rate, or alternatively to participants designated as "Masters.[8] Research finds that MTurk workers are a source of reliable data (Buhrmester, Kwang, and Gosling 2011) and that it is an appropriate participant source for research on nonprofessional investors (Koonce et al. 2015).

We conducted screening procedures to select only participants at least 18 years of age, United States citizens, and that are native English speakers. Also, consistent with prior research

[6] On average, participants spent about 12 minutes to complete the experiment. As such, compensation is deemed reasonable, considering MTurk workers' average hourly wage of $3.00 (Rennekamp, Rupar, and Seybert 2015). Compensation is based on the participant's Mturk qualifications as participants with more HITs completed and with higher approval rates are expected to receive greater compensation considering that these participants have higher approval rates and a low number of abandoned HITs (Farrell, Grenier, and Leiby 2017). Only participants who successfully completed the study and accurately answered all the review questions (including the attention check questions) and manipulation checks were compensated.

[7] The experiment in this study was approved by the Institutional Review Board (IRB) for Human Participants.

[8]" Specifically, 85 participants in our sample have at least 500 completed HITs and 95 percent approval rate and 83 participants that hold the Mturk "Masters" qualification. Amazon grants the "Masters" qualification to workers that consistently demonstrate a high degree of success in performing a wide range of HITs across a large number of requesters. All participants, regardless of their Mturk qualification, are required to meet the additional screening requirements. Participants' demographics are not significantly different between groups, including the time to complete the survey, and the inferences of the study are unchanged when controlling for participant's qualifications as a covariate in the analyses.

that uses MTurk as a source for non-professional investors (e.g., Rennekamp 2012; Koonce et al. 2015; Asay, Elliot, and Rennekamp 2017), participants are required to have taken at least two accounting or finance classes and have experience reading financial statements. On average, participants are 29 to 38 years old and full-time employed. About 60 percent of the participants are male, 72 percent of the participants have at least a bachelor's degree, and 90 percent of the participants have investment experience.[9]

Only participants who successfully completed the study and accurately answered all the review questions (including attention checks) and manipulation checks were compensated. In addition, to alleviate issues of repeated participation, access to the experimental materials is restricted to avoid duplicate responses from the same IP address (Arnold and Triki 2017).[10]

Task

The experimental task requires participants to evaluate a company, based on the information that is available. First, participants are provided with a brief description of the company. We use Aplus Auto Care to resemble a company in the car warranty and related solutions industry. After reading the description of the company, participants are required to make an initial valuation of the company's stock price.

Participants then receive a press release in which the company announces a data breach, along with information regarding the extent of the breach and a link to resources provided by the company to remediate the impact of the breach (e.g., dedicated website, credit monitoring services). The format and content of the press release are consistent with press releases used to announce known data breaches, such as the Home Depot, TJ Maxx, and Target breaches.

[9] 65 percent of the participants have over three years of investment experience.
[10] Consistent with suggestions provided by Arnold and Triki (2017), a reminder about the importance of scientific research was also presented to discourage participants to participate a second time.

Participants also receive selected financial information about the company, background information on assurance over cybersecurity, and information about the presence or absence of assurance (manipulated between participants). After being provided with all the relevant case facts, participants updated their initial valuation of the company's stock price, answer additional case questions, answer manipulation check questions, and provide demographic information.

Independent Variables

The first independent variable is assurance. Assurance is operationalized by notifying participants whether the company engaged or not in CRM assurance for the fiscal year prior to the breach. For the assurance condition, participants learn that the company ***has*** a cybersecurity risk management program in place, controls are operating effectively, the company engaged in voluntary assurance over cybersecurity, and the auditors issued a clean audit opinion. In contrast, for the no-assurance condition participants will be notified that, although the company ***has not*** engaged in assurance over cybersecurity, the company has a cybersecurity risk management program in place and that controls are operating effectively. Before participants are informed about the presence or absence of CRM assurance, they receive general information about the risk of cyber-breaches and cyber-risk management and assurance. In particular, participants are notified about the AICPA initiative to develop a cybersecurity risk management program and are provided with a description of what a SOC for cybersecurity implies.

The second independent variable is expectancies of the presence or absence of assurance. Expectancy is operationalized by providing participants with information on whether the company's decision to engage (or the decision not to engage) in CRM assurance is consistent or inconsistent with industry practices. This manipulation was adapted from Clor-Proell's (2009) work on expected and actual accounting choices and tailored to the context of CRM assurance.

Consistent with Clor-Proell (2009), participants are first provided with information about the industry expectancies and then they receive information about the firm choice to engage or not engage in CRM assurance. Together, these two manipulations (assurance and expectancies) result in two violate-expectancies (there is assurance and assurance is not expected, or there is no-assurance and assurance is expected) and two conform-to-expectancies (there is assurance and assurance is expected, or there is no-assurance and assurance is not expected) conditions.

Dependent Variables

The dependent variable of interest is investors' perceived value of a company stock price (valuation judgments). Our measure of valuation judgments is consistent with the measure used by Asay et al. (2017) that asks for participants' initial valuation judgments (before the manipulations) and for updated valuation judgments after participants are presented with additional information and the manipulations.[11] Valuation judgments are measured using a 7-point, fully labeled, scale that ranges from "very low" (equal to 1) to "very high" (equal to 7).[12] As such, valuation judgment represents a participant's updated valuation judgment using the initial valuation judgment as a covariate.

Management credibility is a mediator in the theoretical model. Consistent with prior research (e.g., Clor-Proell 2009; Mercer 2004; Mercer 2005; Rennekamp 2012), management credibility is measured using participants' assessment of management competence and trustworthiness, the two components of management credibility. To measure participants' assessment of management competence and trustworthiness, we use a 7-point, fully labeled, scale that ranges from "very incompetent" (equal to 1) to "very competent" (equal to 7) and from

[11] Consistent with Asay et al. (2017), participants are anchored on the scale's mid-point to be able to use the initial valuation as a baseline to measure investor's reactions to the manipulations.

[12] Eutsler and Lang (2015) find that a fully labeled 7-point scale provides the greatest benefits to researchers. They argue that labeling results in many benefits, such as reduced response bias, maximization of variance, maximization of power, and minimization of error. They provide evidence that variance is maximized when using 7-point scales.

"very untrustworthy" (equal to 1) to "very trustworthy" (equal to 7), respectively. In order to confirm the validity and reliability of the management credibility construct, we first conducted exploratory factor analysis (EFA) and generated the construct Cronbach's alpha. The results of EFA confirmed that assessment of management competence and assessment of management trustworthiness loads into a single construct with factor loadings of 0.790 and 0.784, respectively, while the construct's Cronbach's alpha is 0.934.[13] As such, we use the average value of these two measures as a single measure of management credibility for the analysis.

IV. RESULTS

Manipulation Checks and Comprehension Questions

The experimental materials were pre-tested with a similar participant pool to confirm the success of the study manipulations. Then, the final version of the experiment was released with three main manipulation check questions, three review questions, and one attention check. Only participants who answered all the main manipulation check questions, review questions, and attention checks were allowed to complete the experimental materials.

The two main manipulation check questions to test the manipulation of the presence or absence of assurance asks participants whether or not Aplus Auto Care engaged in CRM practices and CRM assurance, respectively, based on the case information. The main manipulation check question to test the manipulation of expectancies of assurance asks participants whether or not most firms in the industry choose to engage in CRM assurance practices, based on the case information. An additional question to test the manipulation of expectancies of assurance is included and asks participants about their agreement with the following statement: "Aplus Auto Care was expected to engage in CRM assurance before the

[13] Factor loadings and Cronbach's alpha were all above the recommended threshold of 0.50 and 0.70, respectively (Nunnally 1978).

data breach.[14] We find that participants in the assurance-expected condition (mean=5.11) agree to a greater extent that Aplus Auto Care was expected to engage in CRM assurance (t=-4.090, p<0.001) compared to participants in the assurance-not-expected condition (mean=4.05).

Review questions are included to ensure that participants understand the information provided in the case. One review question is designed to confirm that participants understand the instructions and two review questions are included to ensure that participants understand the selected financial information presented. An attention check question is also included to ensure that participants are actively engaged in the task.

Testing of Hypotheses

Hypothesis 1

H1 predicts that voluntary CRM assurance (no-assurance), prior to the occurrence of a cyber-breach, results in less negative (more negative) investor valuation judgments after the disclosure of a cyber-breach. Panel A of Table 1 presents descriptive statistics for the participant's final valuation judgments adjusted for initial valuation judgments (initial valuation is a covariate in the model).[15] We tested this prediction using analysis of covariance (ANCOVA), and the results are graphically presented in Figure 2 and tabulated in Panel B of Table 1.

~ Insert Table 1 and Figure 2 about here ~

As indicated in Table 1, we find support for the hypothesized relationship between assurance and valuation judgments. Although we do not hypothesize an interaction of assurance and expectancies, the analysis considers this interaction to determine the significance of the direct effect from assurance to valuation judgments. Consistent with our predictions, participants

[14]" The participants use a 7-point, fully labeled, scale that ranges from "strongly disagree" (equal to 1) to "strongly agree" (equal to 7).

[15] Unadjusted means are not significantly different and in the same direction as adjusted means.

in the assurance condition assessed a higher stock value than participants in the no-assurance condition ($F=15.817$, $p<0.001$).

Hypothesis 2

H2a predicts that voluntary CRM assurance (no-assurance), before the occurrence of a cyber-breach, will result in less negative (more negative) investors' assessments of management credibility after the disclosure of a cyber-breach. We present descriptive statistics for participants' assessments of management credibility in Panel A of Table 2. The results of the analysis of variance (ANOVA), tabulated in Panel B of Table 2, support the hypothesized relationship and indicate that assurance is positively associated with assessments of management credibility ($F=54.489$, $p<0.001$). Moreover, H2b predicts that management credibility mediates the relationship of assurance and valuation judgments. Results of the mediation analysis, following Hayes (2017) process analysis, are graphically presented in Figure 3 and tabulated in Panel A and Panel B of Table 3.[16] Inspection of bootstrap confidence intervals for the analysis of indirect effects, included in Panel B of Table 3, confirms the hypothesized mediation.[17] The results suggest that the relationship of Assurance and Valuation Judgments is fully mediated by Management Credibility, as the coefficient of Assurance on Valuation Judgments is not significant ($p=0.797$) when including Management Credibility in the model.

~ Insert Table 2, Table 3, and Figure 3 about here ~

Hypothesis 3

H3a predicts that the effect of CRM assurance on users' assessment of management credibility is more extreme in the presence of expectancy violations. As shown in Panel A of Figure 4, the graphical representation of the interaction of assurance and expectancy violations

[16] We use Hayes (2017) Process model 4 to test mediation.
[17] The analysis of bootstrap confidence interval does not include zero which denotes statistical significance (Hayes 2017).

on management credibility is consistent with the predicted pattern. We present descriptive statistics for participants' assessments of management credibility in Panel A of Table 2. The results of the ANOVA, as presented in Panel B of Table 2, shows a significant interaction between assurance and expectancy violations ($F=9.820$, $p<0.001$). As such, we derive contrast weights to test the predicted disordinal interaction. The results of planned contrast analysis, as presented in Panel C of Table 2, confirm that assessments of management credibility are more extreme in the presence of expectancy violations for, both, positive and negative violations. In particular, contrast weights to test the effect of positive violations on assessments of management credibility (0 for no assurance when assurance is expected, 0 for no assurance when assurances is not expected, -1 for assurance when assurance is expected, and +1 for assurance when assurance is not expected) is marginally significant ($t=1.562$, $p=.061$). Moreover, contrast weights to test the effect of negative violations on assessments of management credibility (-1 for no assurance when assurance is expected, +1 for no assurance when assurances is not expected, 0 for assurance when assurance is expected, and 0 for assurance when assurance is not expected) is significant ($t=2.747$, $p=.004$). Overall, the results support H3a and confirm that investor's expectancies moderate the effect of assurance on assessments of management credibility.

~ Insert Figure 4 about here ~

H3b predicts a moderated mediation in which expectancy violations moderate the effects of CRM assurance on investors' valuations through management credibility as a mediator. A graphical representation of the model is included in Panel 2 of Figure 4. To test the model, we follow Hayes (2017) approach for conditional process analysis.[18] Results of the model estimation

[18] Specifically, following Hayes (2017), the first stage moderation mediation is estimated to assess 1) the direct effect of assurance and the interaction of assurance and expectancy violations on management credibility (the mediator), and 2) the total effect of assurance and management credibility on valuation judgments (the dependent variable). Then, the conditional indirect effect is assessed as the product of the effect of assurance and the effect of the moderation of assurance and expectancy violations on management credibility and the effect of management credibility on valuation judgments, controlling for assurance. The

are consistent with the ANOVA conducted to test H1 and H2. In particular, there is evidence of a significant positive effect of assurance and the interaction of assurance and expectancy violations on management credibility, as shown in Panel A of Table 4. Inspection of bootstrap confidence intervals for the analysis of conditional indirect effects and the index of moderated mediation, included in Panel B and Panel C of Table 4, confirms the hypothesized moderated mediation.[19] Specifically, the analysis reveals that the effect of management credibility on valuation judgments is larger when expectancies are violated (effect = 0.8970) compared to when Assurance conforms to expectancies (effect = 0.3624) and that the difference in these effects is positive and significant.

~ Insert Table 4 about here ~

Additional Analysis

Perceived Benefits of Assurance-as-Insurance – The Insurance Hypothesis

As discussed earlier, we use the Insurance Hypothesis to theoretically motivate the predicted effect of CRM assurance on investors' valuation judgments. This conceptualization is based on Wallace's four arguments for the insurance hypothesis to explain the demand for voluntary assurance as an alternative to traditional insurance products used to control for litigation exposure. Accordingly, we conducted additional analysis to test whether the perceived benefits of using CRM Assurance-as-Insurance (AAI) influence investors' behavior.

First, we developed a four-item formative construct for participants' alignment with the insurance view of assurance, denoted AAI, based on a review of Wallace's (1980) arguments for the demand for assurance as posited through the insurance hypothesis. In particular, we ask

difference between the conditional indirect effect at different values of the moderator (i.e., violate or conform to expectancies) represents the index of moderated mediation used to test the hypothesized relationship. We use PROCESS model 8.

[19] The analysis of bootstrap confidence interval does not include zero which denotes statistical significance (Hayes 2017).

participants about their agreement with beliefs that 1) cybersecurity audits are necessary to substantiate professional care, 2) cybersecurity audits are beneficial as they allow the auditor to be used as a codefendant, 3) cybersecurity audits are beneficial as the auditor and the company shares an interest to protect both of their reputation in case of litigation, and 4) cybersecurity audits are beneficial as the auditor shares a portion of the company's legal responsibility. To validate the construct's validity and reliability, we conducted principal components analysis (PCA) and tested the items for multicollinearity.[20] PCA confirms that all items load on the same construct with item loadings above the 0.5 threshold (Nunally 1978). Moreover, we confirmed that the VIF is below 3.3 (Diamantopoulos and Siguaw 2006) for all items. As such, we use the average value of the four items as a single AAI measure for the analysis.

We find that, on average, participants agree that CRM assurance is beneficial and can be used as an alternative for traditional insurance (mean=5.338). We used a median split based on the median value (5.375) of the AAI variable to generate a Hi/Low AAI dichotomous variable and then we split the sample and re-run all the hypotheses test for each group (Hi and Low perceptions group) to explore the impact of higher (versus lower) perceived benefits of AAI. We present the results, graphically, in Panel A and Panel B of Figure 5. The results of the ANCOVA, untabulated, shows that CRM only results in higher valuation judgments when investors have higher perceptions of the benefits of AAI. In contrast, CRM assurance is positively associated with investors' assessments of management credibility for, both, the higher and lower AAI perception groups. On average, valuation judgments are higher for the Hi-AAI assurance (mean=4.37) group than for the Low-AAI assurance (mean=4.15), but not statistically

[20] In contrast with reflective constructs, formative indicators do not reflect the same underlying constructs and as such multicollinearity is not desirable (Chin, Marcolin, and Newsted 2003). Petter, Strub, and Rai (2007) suggest using PCA, rather than traditional EFA, to assess construct validity and to assess collinearity (i.e., VIF < 3.3) to evaluate the construct's reliability.

significantly different (t=0.687, p=0.217). However, valuation judgments are significantly higher (t=3.340, p<0.001) for the Low-AAI no assurance (mean=3.93.) group than for the Hi-AAI no assurance group (mean=3.20). In addition, only negative violations remain significant for both groups. Last, the results (untabulated) of the mediation analysis and the mediated moderation analysis hold for both groups.

~ Insert Figure 5 about here ~

Altogether, the results suggest that investors' perceptions about the benefits of AAI influences valuation judgments. In particular, results of the ANOVA and inspection of mean valuation judgments between groups, suggest that investors with higher perceptions of the benefits of AAI reward firms that engage in voluntary CRM assurance and penalize firms with no assurance. Also, the results suggest that within these subgroups negative violations result in stronger negative reactions compared to the positive reaction of positive violations.

Perceived Accountant's Cyber-expertise

Prior studies (e.g., Gendron and Barrett 2004) reveal that the perceived accountants' lack of technology expertise may have contributed to the failure of the AICPA and CICA's web assurance initiatives in the early 2000s. Therefore, we conducted additional analysis to explore participant's perceptions of accountant's cyber-expertise (ACE) and to explore how lower and higher perceptions of ACE affect the main analyses.

Accordingly, we developed a four-item formative construct, denoted ACE, adapted from Brazel and Agoglia's (2007) work on auditor's accounting information systems (AIS) expertise. Brazel and Agoglia's (2007) constructs include five items and is intended to capture aspects of domain particular-experience and training, which are believed to be the main determinants of auditor expertise (Bonner 1990). While the items in Brazel and Agoglia's (2007) construct were

developed as a self-reported measure of auditors' AIS expertise, in general, we adapted their items to capture participants' perceptions of accountant's specific cyber-expertise.[21] In particular, we ask participants about their agreement with beliefs that 1) accountants have significant experience auditing information security and cybersecurity controls, 2) accountants spend a significant portion of their time auditing information security and cybersecurity controls, 3) accountants receive significant combined informal and formal training in relation to information security and cybersecurity controls, and 4) accountants have a high level of information security and cybersecurity controls expertise. Consistent with the analysis to test the validity and reliability of the AAI construct, we conducted PCA and confirmed that all items load in the same construct with item loadings above the 0.5 threshold (Nunally 1978) and also confirmed that VIF is below the 3.3 threshold (Diamantopoulos and Siguaw 2006) for all items. Thus, we use the average value of the four items as a single ACE measure for the analysis.

The analysis reveals that, on average, participants disagree that accountants have the sufficient level of domain particular-experience and training necessary to be considered cyber-experts (mean=3.770). We use a median split based on the median value (3.750) of the ACE variable to generate a Hi/Low ACE dichotomous variable and then we split the sample and re-run all the hypotheses test for each group (Hi and Low ACE) to explore the impact of higher (versus lower) perceptions of accountant's cyber-expertise. We present the results, graphically, in Panel A and Panel B of Figure 6. The analysis (untabulated) shows that assurance is positively associated with valuation judgments and assessments of management credibility, regardless of the level of perceived ACE. Nevertheless, we find that valuation judgments are significantly higher (t=2.109, p=0.018) when participants have higher perceptions of ACE and have assurance

[21] All items in Brazel and Agoglia's (2007) AIS expertise construct were included, except for an item that captures auditor's self-reported AIS experience (time) relative to peer auditors.

(mean=4.51) compared to valuations from the Low-ACE assurance group (mean =4.02). Further, assessments of management credibility for the Hi-ACE assurance group (mean=5.45) are marginally significantly higher (t=1.511, p=0.068) than for the Low-ACE assurance group (mean=5.14) but are not significantly different between the Hi and Low-ACE no assurance conditions. Moreover, the result of planned contrast analysis shows that the interaction of assurance and expectancy violations (both positive violations and negative violations) is only significant for the Hi-ACE group. Finally, the results of the mediation analysis (untabulated) hold for both groups, but the hypothesized mediated moderation is only significant for the Hi-ACE group.

Overall, the results indicate that perceived ACE explains investors' decision behavior when evaluating a firm's value and credibility, in light of information about the presence or absence of assurance and industry expectancies. In particular, the analysis suggests that in evaluating a firm's value and management credibility, participants place more weight on their own perceptions of the ACE than on the industry consensus (peer firms behavior).

~ Insert Figure 6 about here ~

Disclosure of Firm's Cyber-risk Management Practices

We also conducted additional analysis to test whether disclosure of the existence (or lack) of management's CRM provides incremental rewards (penalties). In order to explore the value of management's CRM, we collected data for an additional experimental condition in which participants are informed that there is no risk management program and no assurance (84 additional participants were recruited through Mturk).[22] Given that in the main analysis

[22] Participant qualifications and screening are performed consistent with the main experiment. Also, participants were required to answer all the review questions (including the attention check questions) and manipulation checks to be allowed to complete the task.

participants in the assurance condition are notified that the firm engaged CRM and CRM assurance, and the participants in the no assurance condition are notified that the firm only engaged in CRM, the additional data collected yields a 3 x 2 experimental design with assurance/risk management (CRM assurance, CRM-only, and no-CRM) and expectancy violations manipulated between groups.

Mean values are graphically illustrated in Panel A and Panel B of Figure 7. Results of contrast weights (untabulated) support that investors reward firms that disclose the existence of a CRM program. In particular, participants in the CRM-only conform-to-expectancies condition provided higher management credibility ratings (mean=4.40), compared to participants in the no-CRM conform-to-expectancies condition (mean 3.94) and also participants in CRM-only conform-to-expectancies condition provided higher management credibility ratings (mean=3.65), compared to participants in the no-CRM violate-expectancies condition (mean 3.34).[23] Although on average, valuation judgments for the CRM-only condition are higher than for the no-CRM condition, results do not support that there is a statistically significant difference in valuation judgments between groups in the CRM-only and no-CRM conditions.

~ Insert Figure 7 about here ~

V. CONCLUSION

This study provides theoretical and empirical evidence of the cost and benefits of voluntary CRM assurance. Specifically, we find that companies engagement in CRM assurance results in more favorable assessments of management credibility, leading to higher stock price valuations. Moreover, this study finds evidence of positive violations, such that investors reward companies that engage in CRM assurance when assurance is not expected, and negative

[23] Contrast weights are significant (p=.027) for the assurance expected condition (-1,1,0,0,0,0) and marginally significant (p=.099) for the assurance not expected condition (0,0,-1,1,0,0).

violations, such that investors penalize companies that do not engage in CRM assurance when assurance is expected, in the context of assurance.

This study has relevant implications. First, this study is particularly informative to the AICPA as it provides evidence that investors knowledge about whether assurance is expected or not expected, based on industry norms, may help drive the demand for the proposed CRM assurance services. Moreover, additional analyses conducted highlights the importance of users perceptions of the benefits of assurance-as-insurance and their perceptions of accountant's cyber-expertise. These results provide insights to regulators expecting that the market will drive the demand for CRM assurance and CRM disclosures. Specifically, the results suggest, in general, it is users with higher perceived benefits of assurance and higher perceptions of accountant's cyber-expertise that primarily reward and penalize companies as initially hypothesized. As such, the results of this study may help better shape the underlying requirements of the AICPA proposed services and may provide insights on relevant aspects to address, such as marketing initiatives to inform users.

Second, this study informs financial statement stakeholders about the cost and incentives associated with voluntary CRM assurance. In addition to the results of the main analysis, additional analysis sheds light on the benefits of CRM disclosures. In particular, we provide evidence of the incentives associated with CRM practices as companies that disclose the existence of a CRM program receive more favorable investors' assessments of management credibility and stock price valuations, compared to companies that do not have a CRM program in place and operating effectively.

Third, this study contributes to the literature and theory on investor judgment and decision making and provides insights on the factors that explain the market reaction toward

negative events and disasters, such as cyber-breaches, and the potential use of voluntary assurance to mitigate the damage on firms' value and credibility. In particular, this study provides evidence consistent with Wallace's (1980) insurance hypothesis and supports the benefits of voluntary assurance as a tool to control for litigation outcomes after negative events.

The results should be evaluated in light of the inherent limitations, which provide opportunities for future research. First, in order to explore how users' expectancies impact decision behavior, we operationalized expectancies by providing information about whether the firm's CRM assurance practices violate or conform-to-expectancies. However, whether investors are able to form expectancies, based on the industry cyber-risk, is a question beyond the scope of this study. As such, future research could explore whether the results hold without providing information about expectancies but instead by manipulating the type of industry (using industries with different levels of cyber-risk). Moreover, while in this study we hold constant the information provided about the source of the breach, recent research suggests that management responsibility acceptance influences investor's reactions to external breaches (Tan and Yu 2018). Thus, future research could further explore how managements' internal and external attributions influence the variables in our models and impact decision behavior.

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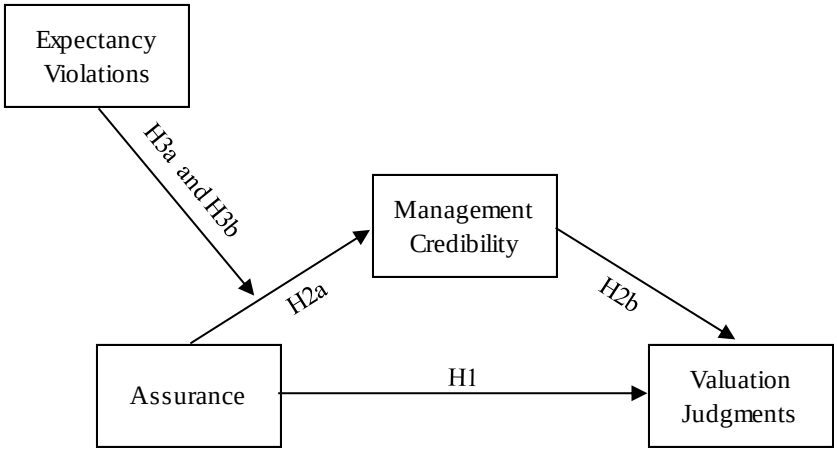
FIGURE 1

Predictions

Panel A: Theoretical Model



Panel B: Interaction between CRM assurance and Conformity with Expectancies on Management Credibility

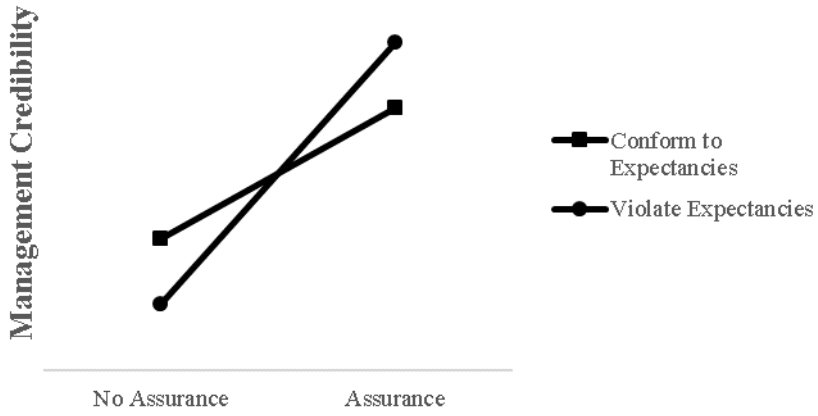


FIGURE 2

Test of H1
Average Valuation Judgments

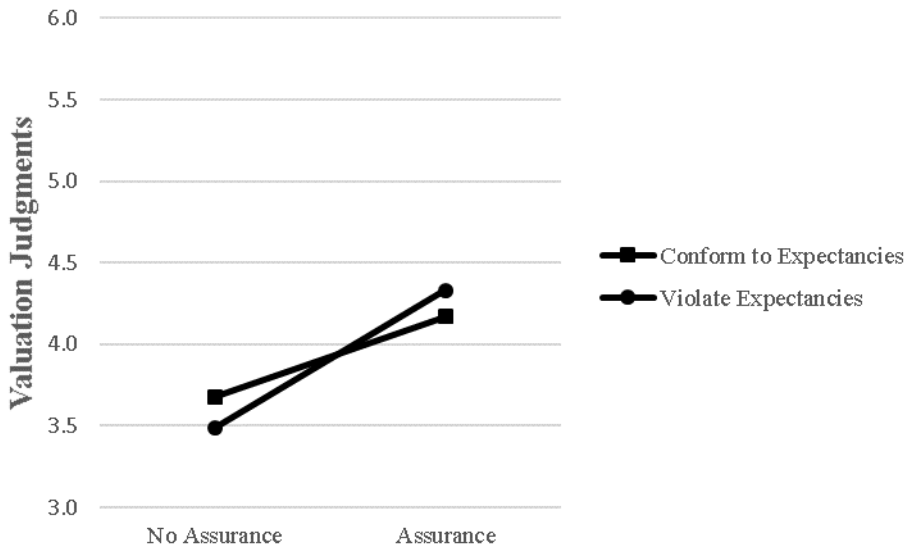
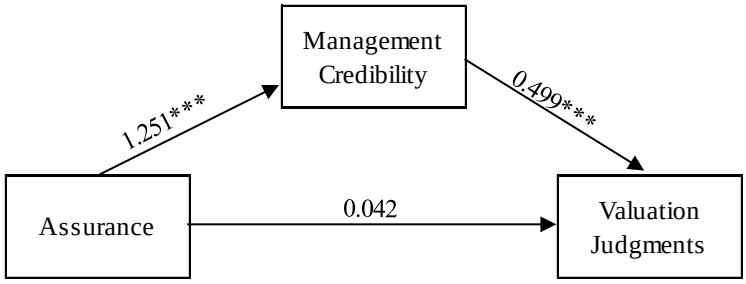


FIGURE 3

Test of H2
Mediation Analysis

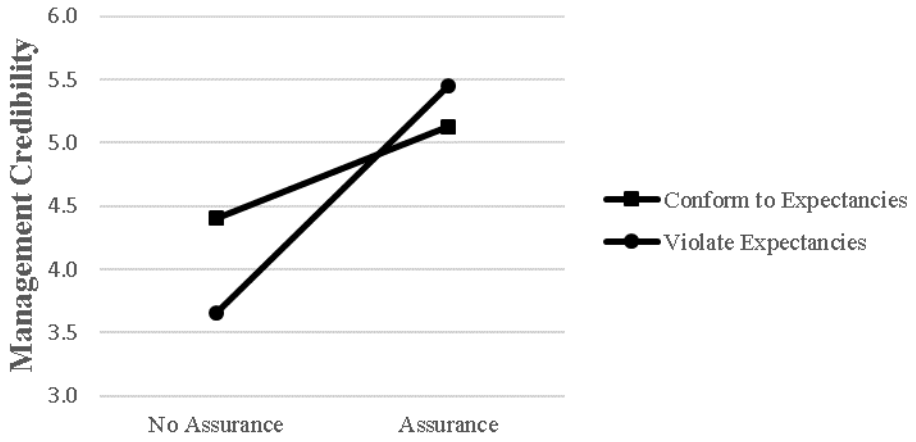


*, **, *** Indicate significance at $p < 0.10$, $p < 0.05$, and $p < 0.001$, respectively.
Variable definitions:
Assurance is a dummy variable coded as one (1) if the company engages in CRM assurance and zero (0) otherwise.
Management credibility is the participant's assessment of management competence and trustworthiness, measured using a scale that ranges from "very incompetent" (equal to 1) to "very competent" (equal to 7) and using a scale that ranges from "very untrustworthy" (equal to 1) to "very trustworthy" (equal to 7), respectively.
Valuation judgments is the participant's perceived value of a company stock price measured using a 7-point, fully labeled, scale that ranges from "very low" (equal to 1) to "very high" (equal to 7).

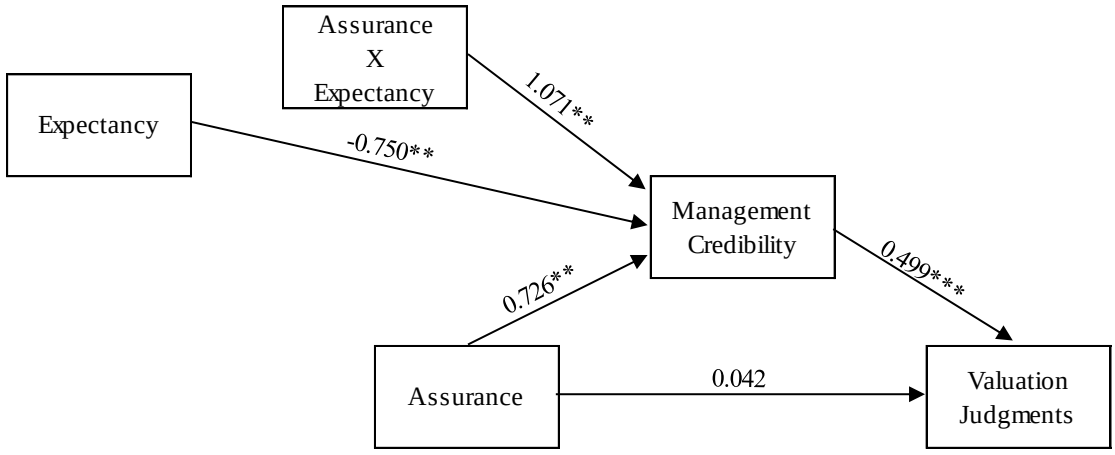
FIGURE 4

Test of H3

Panel A: Average Management Credibility Assessment – H3a



Panel B: Results of Mediated Moderation Analysis – H3b



*, **, *** Indicate significance at $p < 0.10$, $p < 0.05$, and $p < 0.001$, respectively.

Variable definitions:

Assurance is a dummy variable coded as one (1) if the company engages in CRM assurance and zero (0) otherwise.

Expectancy is a dummy variable coded as one (1) if the company violates expectancies about CRM assurance practices and zero (0) otherwise.

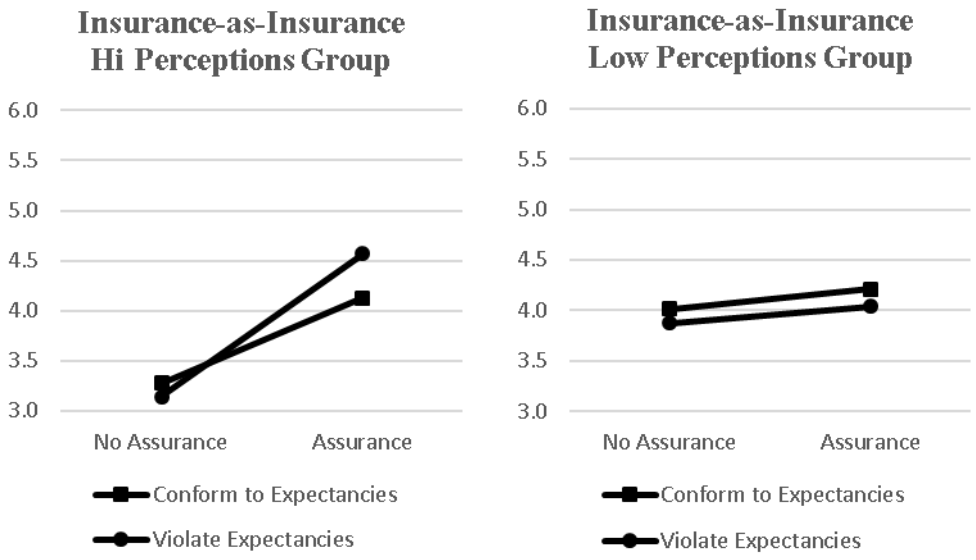
Management credibility is the participant's assessment of management competence and trustworthiness, measured using a scale that ranges from "very incompetent" (equal to 1) to "very competent" (equal to 7) and using a scale that ranges from "very untrustworthy" (equal to 1) to "very trustworthy" (equal to 7), respectively.

Valuation judgments is the participant's perceived value of a company stock price measured using a 7-point, fully labeled, scale that ranges from "very low" (equal to 1) to "very high" (equal to 7).

FIGURE 5

Additional Analysis
Perceived Benefits of Assurance-as-Insurance

Panel A: Average Valuation Judgments



Panel A: Average Management Credibility Assessments

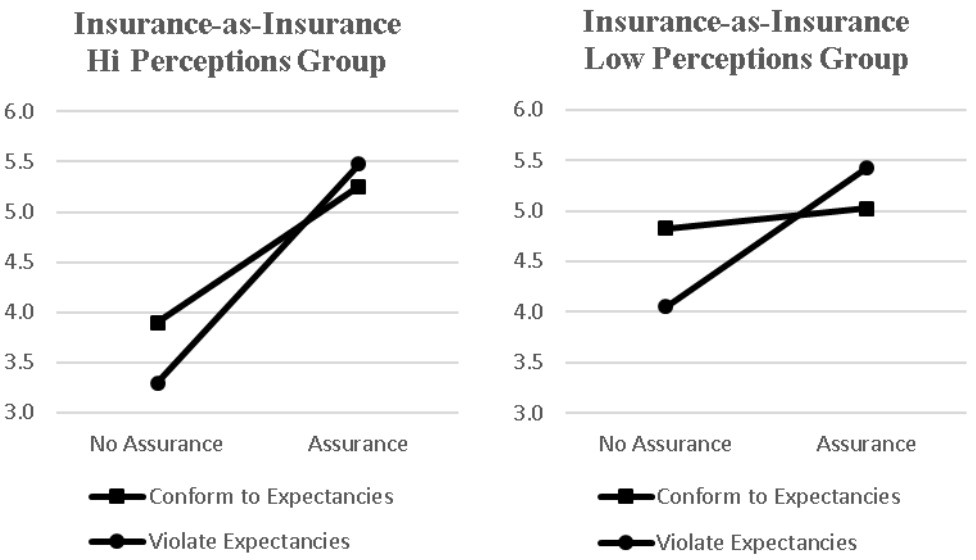
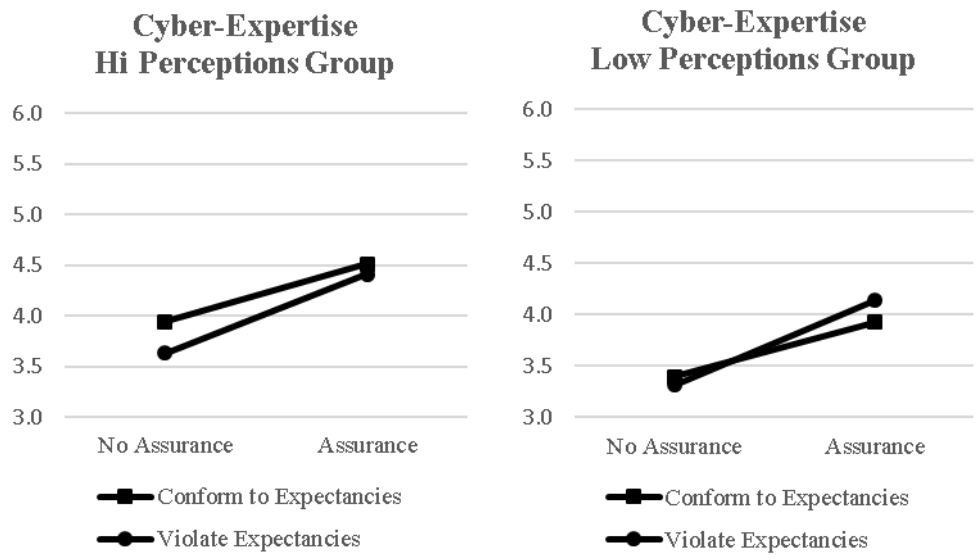


FIGURE 6

Additional Analysis
Perceived Accountants Cyber-Expertise

Panel A: Average Valuation Judgments



Panel A: Average Management Credibility Assessments

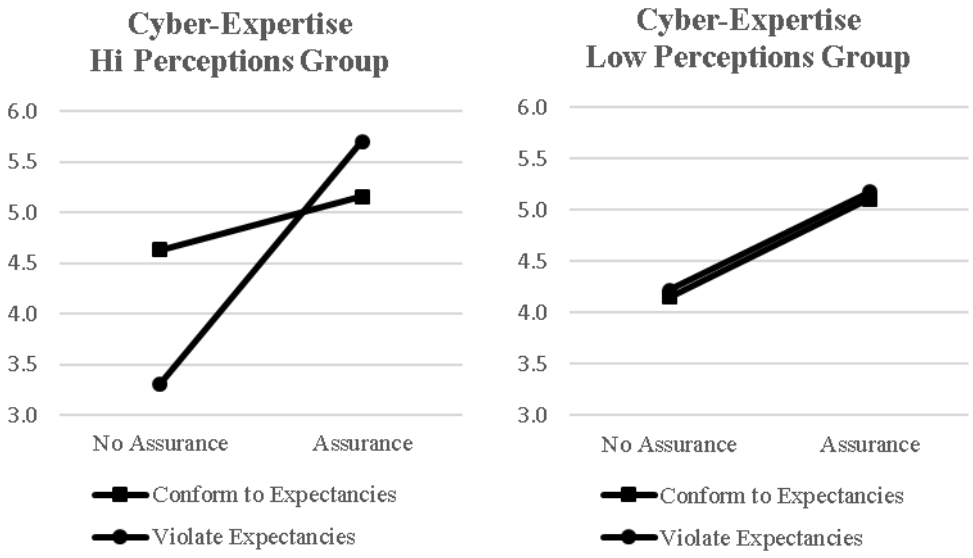
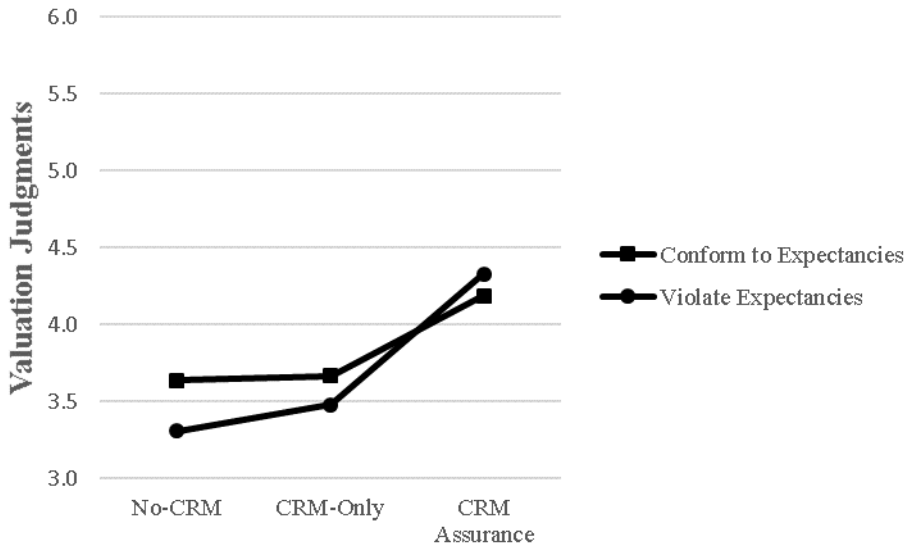


FIGURE 7

Additional Analysis
Firms' Disclosure of Risk Management Practices

Panel A: Average Valuation Judgments



Panel B: Average Management Credibility Assessments

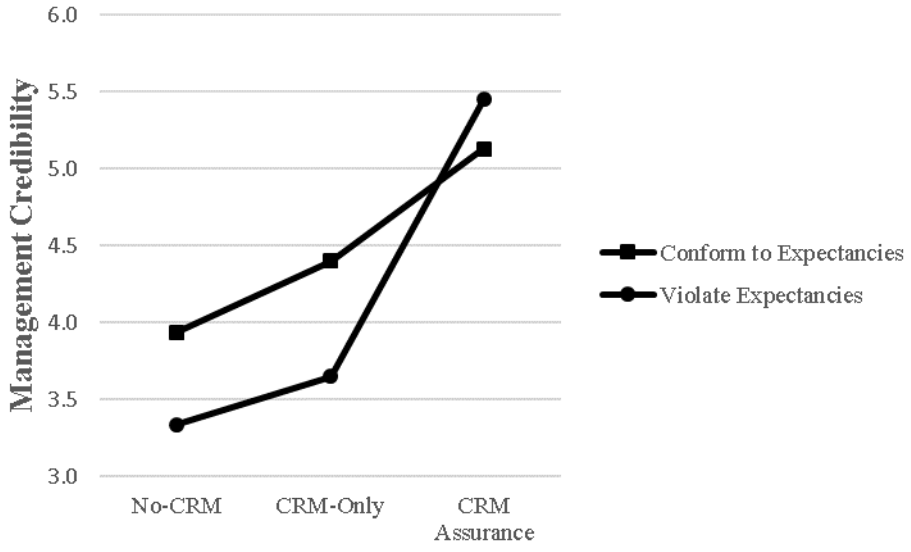


TABLE 1

Test of H1
Average Valuation Judgments

Panel A: Cell Means

	Assurance Expectancies [a]					
	Conform-to-expectancies			Violate-expectancies		
Assurance	**n**	**mean**	**S.D.**	**n**	**mean**	**S.D.**
Assurance	42	4.170	1.048	42	4.329	0.825
No Assurance	42	3.679	1.289	42	3.489	1.212

Panel B: Analysis of Covariance

Source	**d.f.**	**M.S.**	**F-value**	**p-value**[b]
Assurance – ***H1***	1	18.378	15.817	<0.001
Expectancy	1	0.010	0.009	0.926
Assurance * Expectancy	1	1.285	1.106	0.148
Initial Valuation	1	2.229	1.918	0.084
Error	163	1.162		

[a]Reported means are adjusted by initial valuations (mean=4.10). Unadjusted means are not significantly different and in the same direction.
[b]Reported p-values are one-tailed for directional predictions.
[c]The values attached are -1, 1, 0, 0 for the negative violation test; and 0, 0, -1, 1 for the positive violation test.
Variable definitions:
Valuation judgments is the participant's perceived value of a company stock price measured using a 7-point, fully labeled, scale that ranges from "very low" (equal to 1) to "very high" (equal to 7).
Assurance is a dummy variable coded as one (1) if the company engages in CRM assurance and zero (0) otherwise.
Expectancy is a dummy variable coded as one (1) if the company violates expectancies about CRM assurance practices and zero (0) otherwise.
Initial Valuation is the participant's valuation judgment before being presented with the manipulations.

TABLE 2

Test of H2a and H3a
Average Management Credibility Assessments

Panel A: Cell Means

	Assurance Expectancies					
	Conform-to-expectancies			Violate-expectancies		
Assurance	**n**	**mean**	**S.D.**	**n**	**mean**	**S.D.**
Assurance	42	5.131	1.048	42	5.452	0.825
No Assurance	42	4.405	1.289	42	3.655	1.212

Panel B: Analysis of Variance

Source	**d.f.**	**M.S.**	**F-value**	**p-value**[a]
Assurance – ***H2a***	1	66.881	54.489	<0.001
Expectancy	1	1.929	1.571	0.212
Assurance * Expectancy – ***H3a***	1	12.054	9.820	<0.001
Error	164	1.227		

Panel C: Planned Contrast – *H3a*

Contrast[b]	**d.f.**	**M.S.**	**t-value**	**p-value**[a]
Negative Violation	164	0.750	2.747	0.004
Positive Violation	164	0.321	1.562	0.061

[a]Reported p-values are one-tailed for directional predictions.

[b] The values attached are -1, 1, 0, 0 for the negative violation test; and 0, 0, -1, 1 for the positive violation test.

Variable definitions:

Assurance is a dummy variable coded as one (1) if the company engages in CRM assurance and zero (0) otherwise.

Expectancy is a dummy variable coded as one (1) if the company violates expectancies about CRM assurance practices and zero (0) otherwise.

Management credibility is the participant's assessment of management competence and trustworthiness, measured using a scale that ranges from "very incompetent" (equal to 1) to "very competent" (equal to 7) and using a scale that ranges from "very untrustworthy" (equal to 1) to "very trustworthy" (equal to 7), respectively.

TABLE 3

Test of H2b
Mediation Analysis

Panel A: Test of Direct Effects

	Management Credibility		Updated Valuation	
Variable	**Coefficient**	**p-value[a]**	**Coefficient**	**p-value[a]**
Assurance	1.251	<0.001	0.0417	0.797
	(7.064)		(0.257)	
Management Credibility			0.499	<0.001
			(7.998)	
Initial Valuation	0.100	0.575	0.178	0.216
	(0.561)		(1.243)	
Constant	3.624	<0.001	0.839	0.185
	(4.939)		(1.332)	

Panel B: Indirect Effects of Assurance on Valuation Judgments

Mediator	**Effect**	**Boot SE**	**BootLLCI**	**BootULCI**
Management Credibility	0.624	0.131	**0.3903**	**0.8945**

[a]Reported p-values are one-tailed for directional predictions.

T-values are reported in parenthesis. Bold confidence intervals are significant.

Variable definitions:

Management credibility is the participant's assessment of management competence and trustworthiness, measured using a scale that ranges from "very incompetent" (equal to 1) to "very competent" (equal to 7) and using a scale that ranges from "very untrustworthy" (equal to 1) to "very trustworthy" (equal to 7), respectively.

Valuation judgments is the participant's perceived value of a company stock price measured using a 7-point, fully labeled, scale that ranges from "very low" (equal to 1) to "very high" (equal to 7).

Assurance is a dummy variable coded as one (1) if the company engages in CRM assurance and zero (0) otherwise.

Initial Valuation is the participant's valuation judgment before being presented with the manipulations.

TABLE 4

Test of H3b
Mediation and Moderated Mediation Analysis

Panel A: Test of Direct Effects

	Management Credibility		Updated Valuation	
Variable	**Coefficient**	**p-value[a]**	**Coefficient**	**p-value[a]**
Assurance	0.726	0.002	0.042	0.797
	(3.004)		(0.257)	
Expectancy	-0.750	0.002		
	(-3.102)			
Assurance * Expectancy	1.071	0.002		
	(3.134)			
Management Credibility			0.499	<0.001
			(7.998)	
Initial Valuation			0.178	0.216
			(1.243)	
Constant	4.405	<0.001	0.839	0.1846
	(25.766)		(1.332)	

Panel B: Conditional Indirect Effects of Assurance on Valuation Judgments

Mediator	**Expectancy**	**Effect**	**Boot SE**	**BootLLCI**	**BootULCI**
Management Credibility	0	0.3624	0.1419	**0.1156**	**0.6825**
Management Credibility	1	0.897	0.1666	**0.5849**	**1.2407**

Panel C: Index of Moderated Mediation

Mediator	**Index**	**Boot SE**	**BootLLCI**	**BootULCI**
Management Credibility	0.5347	0.1825	**0.2012**	**0.9209**

[a]Reported p-values are one-tailed for directional predictions.

T-values are reported in parenthesis. Bold confidence intervals are significant.

Variable definitions:

Management credibility is the participant's assessment of management competence and trustworthiness, measured using a scale that ranges from "very incompetent" (equal to 1) to "very competent" (equal to 7) and using a scale that ranges from "very untrustworthy" (equal to 1) to "very trustworthy" (equal to 7), respectively.

Valuation judgments is the participant's perceived value of a company stock price measured using a 7-point, fully labeled, scale that ranges from "very low" (equal to 1) to "very high" (equal to 7).

Assurance is a dummy variable coded as one (1) if the company engages in CRM assurance and zero (0) otherwise.

Expectancy is a dummy variable coded as one (1) if the company violates expectancies about CRM assurance practices and zero (0) otherwise.

Initial Valuation is the participant's valuation judgment before being presented with the manipulations.