Essays Examining How Risk Reporting Affects Nonprofessional Investors' Judgments

Inauguraldissertation zur Erlangung der Würde eines DOCTOR RERUM OECONOMICARUM der Wirtschafts- und Sozialwissenschaftlichen Fakultät der Universität Bern

vorgelegt von

Alessandro Cortese

aus Alba, Italien

2024

I

The faculty accepted this thesis on 20 February 2025 at the request of the reviewers Prof. Dr. Alexis H. Kunz and Prof. Dr. Michael Burkert as dissertation, without wishing to comment on the views expressed therein.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

Quantification as a Remedy for Framed Risk Factor Disclosures
by Alessandro Cortese

Do Investors Understand Firms' Market Risk Disclosures? The Effect of Risk Format and Uncertainty on Investment Willingness
by Alessandro Cortese

PREFACE

My dissertation is composed of three papers investigating how risk reporting affects the judgment of nonprofessional investors. Each paper investigates a different and relevant research question related to the field of financial accounting. I employ the experimental method to test my hypotheses and to address my research questions. An important advantage of the experimental method is that researchers can manipulate the constructs of interest while keeping all other factors constant. This ensures that a causal link between the independent and dependent variables can be established. Moreover, experiments also allow me to examine settings that do not yet exist in the real world. For instance, I can investigate how a potential new disclosure requirement that is not currently mandated would affect investors.

In my first study, I explore whether quantifying the risk in the qualitative 10-K risk factor disclosure (RFD) can work as a remedy for framed RFDs. More specifically, I investigate if quantifying the risk mitigates investors' tendency to be more willing to invest in a firm that reports a positively framed RFD compared to a negatively framed RFD. Prior literature established that managers can and do frame financial disclosures to influence investors. Moreover, investigating whether quantifying the risk could counteract the effect of RFD framing is worth pursuing as regulators are considering mandating risk quantification in RFDs. I employ a 2x2 between-subject experiment where I manipulate the framing of the RFD (negative vs. positive) and whether the risk is quantified (no quantification vs. quantification). In line with the framing literature, I find that when risk is not quantified, investors are more (less) willing to invest in a firm that frames its RFD positively (negatively). Furthermore, as predicted, I show that quantifying the risk counteracts the effect of a positively framed RFD, as investors' willingness to invest does not differ between firms framing the RFD either positively or negatively. My study suggests to regulators that mandating risk quantification may benefit investors. This is so because it avoids that investors are more willing to invest in a firm simply because its RFD was framed positively despite identical underlying economics and risk exposure. Requiring risk quantification would limit managers' ability to influence investors via the strategic framing of RFDs. These findings advance our understanding of how qualitative and quantitative elements of the RFD jointly affect investors' judgments.

In my second study, I examine whether investors understand the risk formats used in the 10-K market risk disclosure (i.e., Value-at-Risk (VaR-format) and sensitivity analysis (SA-format)) and how the choice of the format affects their willingness to invest. Due to the different estimation methods of the two risk formats, the VaR-format (SA-format) is more

informative than the SA-format (VaR-format) when uncertainty is low (high). However, I hypothesize that investors do not understand this. I argue that investors rely on the attribute substitution heuristic, using the perceived sophistication of the risk format to infer its informativeness while *disregarding* uncertainty. It is important to investigate whether investors understand these risk formats. If not, it would suggest that what regulators arguably see as an advantage, i.e., disclosure flexibility, is actually misleading investors' judgments. I use a 2x2 between-subject experiment, where I operationalize the risk format as a risk format change (change from VaR- to SA-format vs. change from SA- to VaR-format) and the degree of uncertainty (low vs. high). Consistent with my predictions, investors do not understand the risk formats. They perceive the VaR-format as more sophisticated and informative than the SA-format *independent* of uncertainty. Consequently, in a context of high uncertainty, I find that investors are erroneously more willing to invest in a firm reporting the *less* informative VaR-format compared to the *more* informative SA-format. In contrast, investors seem to consider the reported risk format to be irrelevant when uncertainty is low because the risk is too unlikely to materialize. I additionally show that investors are more willing to invest in a firm reporting the VaR-format because it enhances investors' perception of the management's credibility. These findings show that the risk formats may lead investors to erroneous investment assessments. Lay investors fail to assess the risk formats critically and paradoxically perceive managers reporting the risk less transparently as more credible, which ultimately makes them more willing to invest. Notably, in times of high uncertainty managers face the complex dilemma of disclosing the risk less transparently to improve how investors perceive them *or* disclosing the risk more transparently at the cost of being perceived as less credible. This study contributes new evidence to the risk reporting literature. It improves our understanding of the unintended effects of allowing the communication of risks through different formats with different estimation methods.

In the third study, co-authored with my supervisor Alexis H. Kunz, we investigate how the voluntary choices of a focal firm and a perfectly comparable peer firm to quantify (or not quantify) the risk in their respective RFDs affect investors' perceptions. We are interested in how investors assess the focal firm's risk, the credibility of its management, and its disclosure usefulness. While regulators are considering introducing risk quantification, it is unclear how investors react to the quantification. Even more so in a context where risk quantification is voluntary, so that some firms may decide to quantify while others may not. We predict that investors interpret the risk quantification as an economic signal and a social

signal. Quantifying the risk should increase investors' risk perceptions, but the fact that managers do it voluntarily also improves investors' perceptions of the management credibility. We additionally conjecture that investors' perceptions of management credibility will be strengthened if the focal and the peer firms make a *different* disclosure choice. We employ a 2x2 between-subject experiment to test our predictions. We manipulate the RFD-type reported by the focal firm (qualitative vs. quantitative RFD) and whether the peer firm's RFD-type matches or differs (same vs. different RFD-types). As predicted, quantifying the risk provides an economic signal to investors, who perceive higher risk. Quantifying (not quantifying) the risk is also interpreted as a social signal, leading investors to perceive the management as more (less) credible. This positive (negative) effect is stronger when the peer firm makes a different disclosure choice. Notably, this occurs even though investors have no means to assess whether the management is competent at quantifying the risk. As supplementary analysis, we show that quantifying the risk voluntarily affects how investors perceive the usefulness of the disclosure via their perceptions of the risk and the management's credibility. More precise information on the risk via its quantification results in investors perceiving the investment in the firm as riskier. However, this leads investors to consider the disclosure as more useful as well. Interestingly, we also find that investors associate higher risk with a more credible management, which leads them to assess the disclosure as more useful. Our findings show that investors rely on the risk quantification, as they do not question whether managers are competent at quantifying risks. We do not find support for concerns expressed in the literature that investors might discount quantified risk information. Thus, we caution investors to consider the reliability of the risk quantification before assessing the management and the disclosure. This study also suggests that managers face a trade-off since quantifying the risk makes them appear more credible to investors but also causes an investment in their firm to be perceived as riskier. Finally, our study differs from most in that it investigates a setting in which investors are provided with the financial disclosures of two firms so that they can compare them. While this is arguably a common situation for real-world investors, most of the literature employs experiments featuring only one firm's financial disclosure.

Taken together, my dissertation answers important research questions and contributes to the accounting literature on risk reporting with novel knowledge. It advances our understanding of how risk reporting affects investors, representing valuable evidence for academics, regulators, investors, and managers.

ESSAY 1

Quantification as a Remedy for Framed Risk Factor Disclosures

Alessandro Cortese

University of Bern

ABSTRACT: Firms must describe the risks they are exposed to in the risk factor disclosure (RFD). The RFD is exclusively qualitative, as firms are not required to quantify risks. This implies that the RFD can be framed using positive or negative words (Tan and Yeo 2023). Managers can frame the RFD positively to downplay the risks and increase investors' willingness to invest. However, the SEC is considering whether firms should quantify risks in the RFD (SEC 2016). I investigate whether risk quantification counteracts the effect of RFD framing on investors' willingness to invest. Drawing on the attribute framing theory and the persuasion knowledge model, I predict and find that a positively framed RFD, relative to a negatively framed RFD, increases investors' willingness to invest when the risk is not quantified. Conversely, quantifying the risk prompts investors to see through a positively framed RFD, counteracting its effect. My findings inform investors about how easily they fall prey to the RFD framing. My results are also relevant for standard setters as they show the limitations of a qualitative RFD. They suggest that quantifying the risk may prevent that positively framed RFDs increase investors' willingness to invest.

KEYWORDS: *risk disclosure, attribute framing, quantification, persuasion knowledge model, SEC, 10-K.*

I. INTRODUCTION

Investors evaluating an investment must understand the risks the firm is exposed to. To help investors identify and understand those risks, the Securities and Exchange Commission (SEC) requires firms to disclose the risk factor disclosure (RFD) in the 10-K form (SEC 2005; 2020). Firms must describe the material risk factors they are exposed to and their potential impact. The RFD is qualitative, i.e., managers only describe the risks and their impact with words. This allows managers to frame the RFD to either temper investors' reactions or to warn them explicitly (Tan and Yeo 2023).[1] Framing a RFD by using positive words downplays the negative impact of the risk. Alternatively, managers can be more cautious and frame the RFD by using negative words to emphasize the negative impact of the risk.[2] Thus, framing the RFD positively may lead investors to assess a higher willingness to invest compared to framing the RFD negatively. This is problematic because investors' willingness to invest in firms with the same underlying economics and risk exposure would differ depending on the RFD framing.

Importantly, while firms are not required to quantify the risk in the RFD, the SEC (2016) is considering requiring the quantification of risk. I hypothesize that quantifying the risk may help investors counteract the effect of RFD framing. Quantifying the risk could prompt investors to "see through" a positively framed RFD. That is, they should realize that a positively framed RFD aims to increase their willingness to invest by downplaying the risk's negative impact on the firm. If investors see through a positively framed RFD, they should be able to counteract its positive effect on their willingness to invest. I investigate in an experiment whether framing the RFD positively increases nonprofessional investors' willingness to invest

---

[1] There is variation in the literature regarding the definition of this construct, with some authors using "tone" instead of "framing" (see e.g., Tan and Yeo 2023; Wang 2021). Since I develop my hypotheses based on the attribute framing theory, I use the term "framing". For ease of exposition, I report the results of prior research using the expression „framing" also for those papers that use a different definition of this construct.

[2] It could be argued that more cautious managers would prefer to frame the RFD *neutrally* rather than negatively, as a negatively framed RFD may unnecessarily worry investors. Nevertheless, I define the framing manipulation as "negative" rather than "neutral", in line with previous literature (see e.g., Tan and Yeo 2023).

compared to a negatively framed RFD and if quantifying the risk mitigates this effect. The main contribution of my study is to examine whether the risk quantification can work as a remedy for the effect of positively framed RFDs on investors' willingness to invest.

My research question is relevant as investors are likely to encounter both positively and negatively framed RFDs. Prior literature documents that there is some variance in the framing of the risk disclosures (e.g., Tan and Yeo 2023; Wang 2021; Hanley and Hoberg 2010). Furthermore, the Private Securities Litigation Reform Act appears to have introduced additional protections for managers who provide misleading forward-looking statements (Asay and Hales 2018; U.S. House of Representatives 1995). Therefore, managers may feel even more confident in framing the RFD positively to downplay a firm's risk because, even if the risk materializes, they are unlikely to be held accountable for misleading investors.

Current regulation does not require firms to quantify risks in the RFD (SEC 2005). However, there is variation in the 10-K form, with managers quantifying risks in the market risk disclosure.[3] It is debated whether quantifying the risk should also be mandated in the RFD. Critics point out that the lack of risk quantification questions the RFD's informativeness (Campbell, Chen, Dhaliwal, Lu, and Steele 2014). Consistently, commenters suggested to the SEC that firms should disclose and connect the risk impact to financial results (Lin 2016; CFA Institute 2014). Following this debate, the SEC (2016) asks whether firms should be required to disclose the impact of each risk factor on their performance. Therefore, it is important to understand how quantifying the risk in the RFD affects investors.

To the best of my knowledge, no prior study investigated this research question.[4] He,

---

[3] In the 10-K Form's section "Quantitative and Qualitative Disclosure about Market Risk" firms disclose quantitative and qualitative information regarding their risk exposure deriving from market risk sensitive financial instruments (SEC 1997).

[4] Loraas (2009) investigates the framing and quantification of the benefits and costs of a managerial proposal. Although manipulated at different degrees, the quantified information is present in all conditions. My study differs from Loraas (2009) in several ways. First, I examine how investors' judgments are affected in the settings of the RFD. Loraas (2009) focuses instead on managers' judgment and the persuasiveness of the proposal. Second, in my settings there is no upside potential, whereas Loraas (2009)'s settings also feature upside potential in the form of the proposal's benefits. Third, I manipulate whether the risk *is quantified or not*, as opposed to varying the degree of quantification as in Loraas (2009). Finally, Loraas

Tan, Yeo, and Zhang (2019) show that mismatching risk disclosure formats (quantitative vs. qualitative) of a hedged item and its hedging instrument impede investors' understanding of the net risk exposure. However, they do not manipulate the qualitative disclosure. Tan and Yeo (2023) examine how framing the RFD and disclosing additional risk management information affect investors' stock valuation. They do not formulate an explicit hypothesis on the effect of RFD framing in absence of risk management information. Nevertheless, they find weak evidence that investors assess lower stock valuations when the RFD is positively framed. The authors suggest that the absence of risk management information may lead investors to conclude that managers frame the RFD positively to downplay the risk but fail to take any action to actually mitigate the risk. I contribute to this literature by developing an explicit theory-driven hypothesis on the effect of RFD framing. Additionally, I investigate whether quantifying the risk can counteract the effect of a positively framed RFD on investors' willingness to invest.

This research question is not without tension. Individuals may not rely on quantified information. In a managerial decision setting, Kadous, Koonce, and Towry (2005) show that a quantified proposal is not more persuasive than a non-quantified proposal when the preparers have incentives to mislead. Similarly, Cortese and Kunz (2024) suggest that it is unclear a priori whether investors perceive the risk quantification as credible. Quantifying the risk may be considered unfeasible, even after the risk has materialized (e.g., Marks 2022). Moreover, quantifying a firm's strategic risks may be considered an overstatement of the available information (Stoel, Ballou, and Heitger 2017). Since some risk types are difficult to model, subjective evaluation plays a more significant role (Ballou, Heitger, and Stoel 2011). If investors consider the risk quantification unreliable, they will likely disregard it. Moreover,

---

(2009) investigates whether quantified proposals are more persuasive than qualitative proposals, while I examine whether quantifying the risk may help investors to de-bias their judgement from the framing effect.

investors may question the management's competence if they quantify the risk in the RFD (Cortese and Kunz 2024). Thus, research shedding light on whether risk quantification can counteract the effect of a positively framed RFD on investors seems warranted.

Based on the attribute framing literature (Levin, Schneider, and Gaeth 1998) and the persuasion knowledge model (Friestad and Wright 1994), I hypothesize that a positively (negatively) framed RFD evokes positive (negative) associations in investors' memory when they encode the information. These positive (negative) associations should cause investors to perceive the risk reported in the RFD as less (more) threatening for the firm. Consequently, I expect investors to assess a higher willingness to invest when the firm reports a positively framed RFD compared to a negatively framed RFD. However, I posit that quantifying the risk in the RFD enables investors to realize that a positively framed RFD is a persuasion attempt. They understand that the RFD was framed positively to persuade them that the firm's risk is less threatening. In this case a positively framed RFD should not increase investors' willingness to invest. That is, quantifying the risk should counteract the effect of a positively framed RFD. Finally, I hypothesize that quantifying the risk does not affect investors when the RFD is negatively framed. A negatively framed RFD emphasizes the risk's impact, which is consistent with the cautioning nature of the RFD. Therefore, investors should not view a negatively framed RFD as a persuasion attempt intended to increase their willingness to invest, regardless of the risk quantification.

To test my hypotheses, I design a 2x2 between-subject experiment. I manipulate the framing of the RFD (negative vs. positive) and whether the risk is quantified (no quantification vs. quantification).[5] Participants assume the role of potential investors and assess the firm, the RFD, and the management. Koonce, Mongold, Quaid, and White (2024) suggest that the

---

[5] An experiment allows to manipulate the RFD framing and risk quantification, while controlling for all other factors. Notably, the firm's underlying economics and risk exposure are kept constant.

experimental method is particularly useful for testing the effect of standards under consideration, as archival data is not yet available. An experiment is suitable for investigating this research question because it allows me to create the settings of a RFD with the risk quantification and test how it affects investors. This would otherwise be impossible to investigate with an archival study, as risk quantification is not currently required in the RFD.

My results indicate that the risk quantification may work as a remedy for the effect of a positively framed RFD. Consistent with the attribute framing theory (Levin et al. 1998), when the risk is not quantified, I find that investors assess a higher willingness to invest when the firm reports a positively framed RFD compared to a negatively framed RFD. Conversely, when the risk is quantified, investors' willingness to invest does not differ between firms reporting either positively framed or negatively framed RFDs. My results also point out that quantifying the risk does not affect investors when the RFD is negatively framed. Taken together, I show that risk quantification is not a diagnostic signal per se in driving investors' assessments. However, risk quantification prompts investors to see through a positively framed RFD and counteract its effect on their willingness to invest.

These findings have important implications for regulators, investors, preparers, and academics. My study informs regulators that quantifying the risk in the RFD can be a remedy for the effect of a positively framed RFD on investors' willingness to invest. That is, it avoids that investors are more willing to invest simply because the RFD is positively framed *ceteris paribus*. In line with Cortese and Kunz (2024), my results do not support the concerns of the risk management literature that risk quantification may be discounted because investors consider it as unreliable. My findings help regulators to decide whether requiring firms to quantify the risk in the RFD would benefit investors. They suggest that as long as the risk is not quantified, preparers can easily increase investors' willingness to invest by framing the RFD positively. Finally, my study also contributes to the literature on risk disclosures,

deepening our understanding of how manipulating qualitative (framing) and quantitative (risk quantification) elements of the disclosure can affect nonprofessional investors.

The remainder of the paper is structured as follows: In section II, I present background information, theory, and hypotheses. In section III, the method is illustrated. I discuss the results in section IV, and finally, section V concludes.

II.   BACKGROUND, THEORY, AND HYPOTHESES

Risk Factor Disclosure

The SEC requires registrants (firms) to report the RFD in the 10-K (SEC 2005). This section serves "to disclose the material factors that make an investment in the registrant or offering speculative or risky" (SEC 2020, p. 70). The RFD consists of a qualitative description of each risk factor and its potential impact on the firm with *words only* (see Appendix A for RFD examples). Most of the research on the RFD examines its informativeness, with studies focusing on the specificity of the information reported in the RFD rather than its framing. Hope, Hu, and Lu (2016) show that more specific (i.e., less boilerplate) RFDs lead to stronger market reactions and more reliable analyst forecasts. Campbell et al. (2014) suggest that RFDs are not boilerplate, and investors use its information when evaluating the firm. However, there is evidence suggesting that the informativeness of the RFD decreased significantly after the 2008 financial crisis (Beatty, Cheng, and Zhang 2019). Regulators also appear concerned that the RFD is becoming lengthy and boilerplate. To address this issue, the SEC (2020) now requires firms to provide a summary of the principal risk factors if the RFD is longer than 15 pages. Nonetheless, this new requirement does not appear to affect investors (Durney, Smith, and Wynes 2024).

Disclosure framing

Since the RFD is purely qualitative, managers can positively frame the RFD to downplay the risks. Conversely, they may frame the RFD negatively to emphasize the risks. Huang, Teoh, and Zhang (2014) show that managers strategically frame the disclosure to manipulate investors' judgments upwards or downwards. They find that the framing of an earnings press release is significantly more positive when the firm has incentives to bias investors' perception upwards (e.g., M&A operations, new equity issuances, meeting or beating earnings forecasts), whereas it is more negative when awarding stock options.[6] Therefore, how managers frame the RFD plays an important role, as it is reasonable to expect that investors will be more willing to invest in a firm if they perceive it as less risky *ceteris paribus*. This implies that the framing of the RFD may ultimately influence investors' willingness to invest.

As financial disclosures often feature a qualitative component, the archival literature investigates how disclosure framing can influence investors. A more favorable 10-K disclosure reduces the volatility of stock returns (Kothari, Li, and Short 2009), while changes in 10-K textual risk disclosures are positively associated with changes in daily stock return volatility (Kravet and Muslu 2013). Similarly, the framing of the MD&A forward-looking statements correlates positively with future performance and changes in the framing correlate with short-term market returns (Li 2010; Feldman, Govindaraj, Livnat, and Segal 2010). Davis, Piger, and Sedor (2012) document that positively framed earnings press releases are associated with higher future performance. Notably, the authors could not rule out that managers strategically use the positive framing to mislead investors.

Experimental studies also indicate that disclosure framing influences investors. Tan,

---

[6] See Appendix A in Tan and Yeo (2023) for evidence showing that managers frame the RFD positively and negatively.

Wang, and Zhou (2014) document that when the readability of an earnings disclosure is low, a positively framed disclosure leads unsophisticated investors to judge it more favorably, whereas more sophisticated investors judge it less favorably. While the positive framing improves less sophisticated investors' perception of the firm's performance, more sophisticated investors deem a positively framed and hard-to-read disclosure as less credible. Tan and Yeo (2023) investigate how framing a qualitative RFD and disclosing risk management information affects investors. Providing risk management information leads investors to assess a higher stock valuation when the RFD is positively framed but has no effect when negatively framed. Since the negative framing of the RFD does not match the positive framing of the risk management information, the authors argue that investors may perceive the risk management information as less credible. Conversely, they do not formulate an explicit hypothesis on the effect of the RFD framing *in absence* of risk management information. They find marginally significant evidence that investors assess a lower stock valuation when the RFD is positively framed compared to being negatively framed. The authors suggest as possible explanation that investors may conclude that the management frames the RFD positively to downplay the risk but fails to take any action to *actually mitigate* the risk.

Furthermore, another stream of the literature focuses on how framing affects auditors. This research supports the idea that framing is a pervasive phenomenon, as it can also influence the behavior of trained professionals such as auditors. Namely, they tend to require more substantive testing when asked to focus on the *risks* of the internal control system than when asked to focus on its *strengths* (Emby 1994; Emby and Finley 1997). They recall more negative information on a high-risk client when presented with a negatively framed decision aid compared to a positively framed one (Bedard and Graham 2002). Consistently, Maksymov, Nelson, and Kinney (2018) find that auditors plan more audit hours when the description of the

9

audit step is negatively framed compared to positively framed.[7]

Taken together, the accounting literature has extensively shown that framing can systematically influence the judgment of investors. As managers can easily manipulate the framing of the RFD to mislead investors, it is important to identify potential solutions that could eliminate or at least mitigate this effect.

RFD framing and risk quantification

Attribute framing consists of a frame casting information in a positive or negative light about a characteristic of an object or an event (Levin et al. 1998).[8] The positive framing of an attribute leads individuals to more favorable evaluations compared to the negative framing, as it elicits individuals to evoke favorable associations in memory when encoding the information (Levin et al. 1998; Levin and Gaeth 1988; Levin 1987). For instance, individuals judge the quality of the same ground beef significantly more favorably when described as "75% lean" compared to the equivalent "25% fat" (Levin 1987). Although reduced, the framing effect is still significant even after tasting the meat (Levin and Gaeth 1988). Attribute framing is an ubiquitous phenomenon that researchers have extensively documented in various contexts, such as consumer products, medical treatments, radio news broadcasting, personnel selection, and audit judgment (Levin et al. 1998).

Investors must base their assessment on the RFD's qualitative description of the risk if the risk is not quantified. Drawing on attribute framing, I predict that positively (negatively) framing the RFD using positive (negative) words will evoke favorable (unfavorable) associations in investors' memory when encoding the RFD's information. These positive (negative) associations should cause investors to perceive the risk as less (more) threatening.

---

[7] Example of a positively (negatively) framed audit step used in Maksymov et al. (2018, p. 73): "Assess whether the fair-value measurement reconciles (does not reconcile) to the financial statements.".

[8] See Levin et al. (1998) for a review of the framing literature.

Thus, I expect investors to assess a higher willingness to invest when the RFD is positively framed compared to a negatively framed RFD *ceteris paribus*.

H1: Without risk quantification, investors' willingness to invest is higher when the firm reports a positively framed RFD compared to a negatively framed RFD.

I further maintain that risk quantification may help investors see through and thus counteract the effect of the positive framing. Prior accounting literature shows that individuals appear to attend to quantitative information. Auditors judge the quantitative information to be more useful in assessing whether sufficient information was provided (Anderson, Kadous, and Koonce 2004). They prioritize quantitative evidence over qualitative evidence to a greater extent when the quantified information is more detailed (Joe, Vandervelde, and Wu 2017). Individuals rely more on quantitative cues than qualitative cues when making a capital investment decision (Ang and Trotman 2015). Consistently, investors consider a qualitative sensitivity analysis as less informative than a quantitative one and consequently are less willing to invest (Eilifsen, Hamilton, and Messier 2021).

By positively framing the RFD, managers downplay the firm's risk exposure. In other words, managers try to persuade investors to invest in the firm, by conveying the message that the firm is not exposed to significant risks. The persuasion knowledge model (PKM) provides a theoretical framework for understanding consumers' behavior in response to persuasion attempts (Friestad and Wright 1994). The term "persuasion attempt" refers to a "target's perception of an agent's strategic behavior in presenting information designed to influence someone's beliefs, attitudes, decisions, or actions" (Friestad and Wright 1994, p. 2). The model indicates that the target of the persuasion attempt may not be able to detect the persuasive nature of the message. In this case, the target does not process the message as deliberately intended to influence his/her judgment. In contrast, when the target notices elements revealing that the message is a persuasion attempt, a "change of meaning" occurs. That is, after detecting

the persuasion attempt, the target processes the message while being aware of its persuasive goal. Detecting that the message has a persuasive goal changes how the target assesses it. Specifically, the PKM suggests that the target may draw inferences about, dismiss, or discount the message.

In order to detect a positively framed RFD as a persuasion attempt, I posit that investors must deliberately process the RFD. When presented with financial communications, investors can either engage in Type I or Type II processing (Hamilton and Winchel 2019).[9] The probability that individuals switch from the intuitive response (Type I) to a more deliberate response (Type II) is influenced by their feeling of rightness, i.e., to what degree they sense their initial intuitive response to be correct (Thompson, Prowse Turner, and Pennycook 2011). Individuals presented with inconsistent pieces of information will more likely engage in deliberate reasoning (Type II) because they do not feel confident about their first intuition (Thompson et al. 2011).

H1 predicts that a positively framed RFD increases investors' willingness to invest. This is so because I expect that investors do not detect a positively framed RFD as a persuasion attempt when the risk is not quantified. Conversely, I posit that quantifying the risk in the RFD prompts investors to do so. Quantifying the risk makes its potential negative impact more salient to investors. This means that investors are presented with inconsistent information when the RFD is positively framed and the risk is quantified. A positively framed RFD makes the risk appear less threatening, whereas quantifying the risk highlights its negative impact on the firm in case it materializes. This inconsistency should reduce investors' feeling of rightness and elicit deliberate Type II processing, making investors more likely to detect a positively framed RFD as a persuasion attempt. Investors would then assess their willingness to invest

---

[9] Psychology literature describes Type I processing as "fast, automatic, effortless, associative", whereas Type II processing is "slower, serial, effortful and deliberately controlled" (Kahneman 2003, p. 1451).

knowing that the RFD has been positively framed to persuade them to invest. Consequently, I expect that, when the risk is quantified, a positively framed RFD does not affect investors. This implies that their willingness to invest should not differ between firms reporting either positively framed or negatively framed RFDs.

H2: With risk quantification, investors' willingness to invest does not differ between firms reporting either positively framed or negatively framed RFDs.

Levin et al. (1998) suggest that certain outcomes have an inherent framing. Given that the RFD warns investors about the potential negative impact of risks, it is reasonable to argue that the negative framing is inherently consistent with the cautious nature of the RFD. Thus, investors should not view a negatively framed RFD as a persuasion attempt, *even* when the risk is quantified, as there is no inconsistency between the negative framing and the risk quantification. Therefore, I argue that risk quantification should not influence investors' willingness to invest when the RFD is negatively framed.

H3: The quantification of the risk does not affect investors' willingness to invest when the RFD is negatively framed.

My theory predicts an ordinal interaction in which framing the RFD positively increases investors' willingness to invest, but only when the risk is not quantified. Furthermore, quantifying the risk does not affect investors' willingness to invest when provided with a negatively framed RFD.

My hypotheses are not without tension. Quantifying the risk may cause investors to perceive a higher investment risk. Investors could, in turn, assess a lower willingness to invest not only for positively framed RFDs but also negatively framed RFDs. Similarly, investors may think that risks cannot be quantified reliably. This implies that quantifying the risk could signal management's incompetence and/or that the RFD is unreliable, causing investors to

reduce their willingness to invest.

III.   METHOD

I recruited 284 Amazon Mechanical Turk workers through the platform CloudResearch. I excluded 15 observations from participants who failed the comprehension check to ensure a higher data quality.[10] The final sample comprises 269 unique observations. Participants are 52% (48%) female (male) with an average age of 45 years. At the time of the experiment, participants took 3.81 accounting and finance university courses and had 23.22 years of work experience. Furthermore, 81% invested in common stock or would do so in the future.

Experimental design

I use a 2x2 between-subject experiment to test my hypotheses.[11] I manipulate the framing of the RFD (negative vs. positive) and whether the risk is quantified (no quantification vs. quantification). I design the background information on the firm and the framing manipulation based on Tan and Yeo (2023). I run the experiment on the online survey platform Qualtrics. Participants received a fixed compensation of $3 for completing the experiment. They spent an average (median) of 10.72 (7.82) minutes to complete the experiment, resulting in an average (median) hourly rate of $16.79 ($23.02).

Participants access the experiment and are informed about the fixed compensation for completing the experiment. They consent to the analysis and anonymous publication of data and learn that they will assume the role of a potential investor. Next, participants view background information about the firm and a graph showing the firm's net income trend over the last five years. Participants then read the RFD, which reports the risk of a disruption in the

---

[10] Including these participants in my analysis does not change the main inferences of my results.

[11] IRB-approval was granted for the experiment by the ethics committee at the author's institution.

supply of raw materials. Depending on the conditions, the RFD is framed positively or negatively. The positively (negatively) framed RFD uses positive (negative) words to describe the risk. In the "quantification" conditions, the RFD ends with an additional sentence disclosing the quantified net income reduction if the risk materializes. The potential reduction amounts to the 25% of the last reported net income (See Appendix B for an overview of the experimental manipulations). Consistent with the 10-K market risk disclosure (SEC 1997), I design the risk quantification as a single point estimate.[12] Participants assess the firm, the management, and the RFD. Finally, in the last part of the experiment they answer manipulation checks, a comprehension test, and demographic questions.

IV. RESULTS

Manipulation checks

I ask participants to rate the tone of the RFD on a 101-point Likert scale ranging from negative (endpoint = 0) to positive (endpoint = 100). The wording of this manipulation check is adopted from Tan and Yeo (2023). Since I base the framing manipulation on their experiment, I adopt their manipulation check to ensure comparability.[13] Investors assessing a more positive tone for positively framed RFDs relative to negatively framed RFDs would indicate a successful manipulation. Consistently, participants provided with a positively framed RFD assess a more positive tone compared to the negatively framed RFD (49.47 vs. 43.08, t_{267} = -3.20, p < 0.01, untabulated).[14] Moreover, I present participants with the quantified risk shown in the "quantification" conditions. 87% of participants correctly identified whether the RFD they viewed showed the quantified risk. I conclude that participants successfully

---

[12] Investors may consider a single point risk quantification to be unreliable, signaling management's incompetence. However, my results show that risk quantification does not affect investors' perception of management's competence (See paragraph "Ruling out alternative explanations").

[13] Asking participants about the tone instead of the framing should also ensure that they can easily understand the question. Framing is arguably a less familiar concept to lay investors compared to the tone of a communication.

[14] All p-values are two-tailed unless stated otherwise. One-tailed p-values are used for testing directional predictions.

responded to my manipulations.

Results

My hypotheses predict an ordinal interaction. When the risk is not quantified, a positively framed RFD should lead investors to assess a higher willingness to invest compared to a negatively framed RFD (H1). Conversely, when the risk is quantified, investors' willingness to invest should not differ between firms reporting either positively framed or negatively framed RFDs (H2). Finally, my theory suggests that risk quantification does not affect investors' willingness to invest when the RFD is negatively framed (H3). The primary dependent variable investment willingness is measured as a composite measure of investment willingness and investment attractiveness, as rated by investors on a 101-point Likert scale.[15] The Cronbach's α for these items is 0.94, indicating good reliability (Nunnally and Bernstein 1994). Table 1 reports the descriptive statistics of investment willingness.

Since I predict a nonsymmetrical ordinal interaction, I run an ANOVA with planned contrast to test my overarching theory (Buckless and Ravenscroft 1990). I follow Guggenmos, Piercey, and Agoglia's (2018) three-steps approach to test my hypotheses using contrast coding: visual evaluation of fit, test of significance and contrast variance residual. First, I check whether the predicted and actual patterns of results visually match. Figure 1 reports the predicted pattern of results (left-hand side) and the actual pattern of results (right-hand side). The actual pattern of results appears to be visually consistent with the predicted pattern. Next, I test the significance of the proposed contrast coding. In line with my hypotheses, I use the following contrast weights: -1 (Negative / No quantification), -1 (Negative / Quantification), -1 (Positive / Quantification), and + 3 (Positive / No Quantification).

---

[15] Following prior literature, investment willingness and investment attractiveness capture investors' valuation of the firm's stock and the stocks' attractiveness as an investment (Koonce and Lipe 2010; 2017). I define the composite measure "investment willingness" for ease of exposition.

TABLE 1: Descriptive Statistics of Investment Willingness

Descriptive Statistics

	Investment Willingness		
	Mean	(SD)	n
Negative / No Quantification	57.59	(20.96)	65
Negative / Quantification	54.84	(22.90)	67
Positive / No Quantification	64.16	(20.48)	67
Positive / Quantification	57.09	(22.46)	70

———————————————

Negative and Positive refer to the Framing of the RFD. No Quantification and Quantification refer to the Quantification of the risk impact on the firm's net income in case of materialization. Values reflect the mean of the dependent variables investment willingness and investment attractiveness as reported by participants on a 101-point Likert scale. The Cronbach's α is 0.94, indicating good reliability (Nunnally and Bernstein 1994).

The results of the ANOVA and planned contrast are reported in Table 2, panels A and B. I find that the planned contrast is significant ($F_{1,265} = 6.24$, $p = 0.01$), whereas the residual is not significant ($F_{2,265} = 0.30$, $p = 0.74$). As a third and final step, I provide a quantitative evaluation of the residual variance. The measure "q^2" indicates the proportion between the unexplained residual variance and the total explainable variance (Guggenmos et al. 2018). The q^2 of the contrast coding is 0.09, indicating that 91% (9%) of the systematic variance is (is not) explained by the proposed contrast. In panel C, I report the simple effects, which are consistent with the predicted pattern of results. Specifically, investors assess a higher willingness to invest in a firm reporting a positively framed RFD compared to a negatively framed RFD when the risk is not quantified (64.16 vs. 57.59, $F_{1,265} = 3.02$, $p = 0.04$, one-tailed). Conversely, when the risk is quantified, investors' willingness to invest does not differ between firms reporting either positively framed or negatively framed RFDs (57.09 vs. 54.84, $F_{1,265} = 0.36$, $p = 0.55$). Moreover, risk quantification does not affect investors' willingness to invest when the RFD is negatively framed (57.59 vs. 54.84, $F_{1,265} = 0.53$, $p = 0.47$). Finally, quantifying the risk, relative to not quantifying the risk, leads investors to assess a lower willingness to invest when the RFD is positively framed (57.09 vs. 64.16, $F_{1,265} = 3.63$, $p = 0.03$, one-tailed).

FIGURE 1: Contrast Coding - Visual Evaluation of Fit
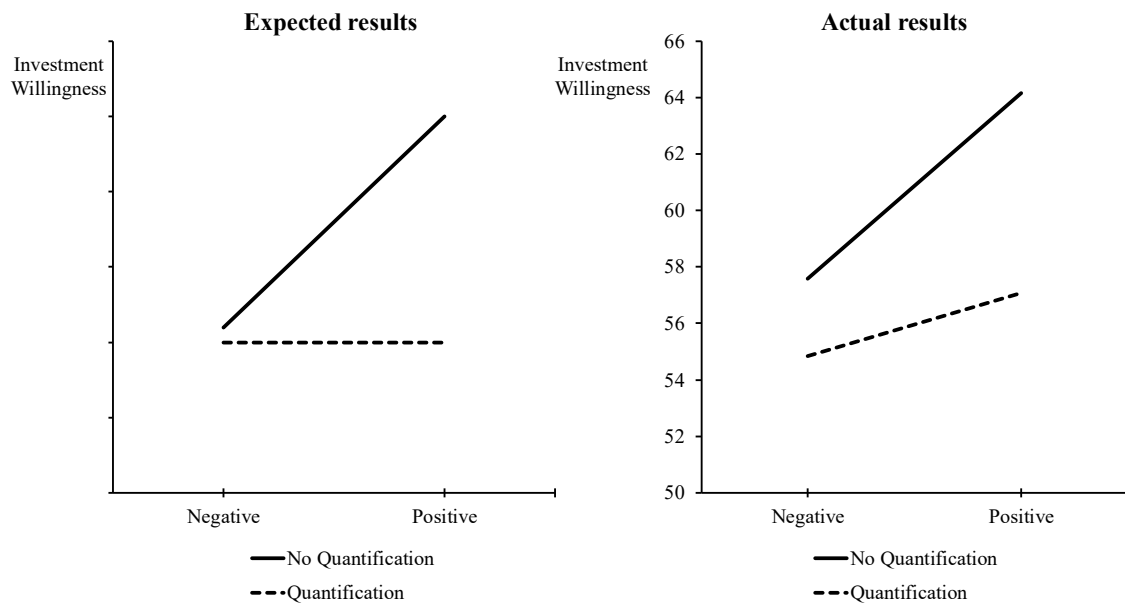
Figure 1 depicts the predicted results based on my hypotheses (left-hand side) and the actual results (right-hand side). Specifically, the right-hand side of the figure shows the results of the ordinal interaction between the Framing of the RFD (negative vs. positive) and the Risk quantification (no quantification vs. quantification) on Investment Willingness. Investment Willingness is measured as a mean score of investment willingness and investment attractiveness as reported by participants on a 101-point Likert scale.

Taken together, my results provide support for my hypotheses. Consistent with the findings of the framing literature, investors fall prey to the positive framing of the RFD when the risk is not quantified. However, as predicted, quantifying the risk seems to prompt investors to identify the positively framed RFD as a persuasion attempt and counteract its effect. My results also appear to support the idea that investors perceive the cautioning nature of the RFD to be inherently consistent with the negative framing. Investors do not suspect to be the target of a persuasion attempt when the RFD is framed negatively, as risk quantification does not affect their willingness to invest. This shows that investors do not consider the quantification of the risk as an isolated diagnostic signal. Risk quantification affects investors' judgments, but only when the risk is communicated in a positively framed RFD. That is, quantifying the risk appears to work as a remedy for positively framed RFDs.

TABLE 2: ANOVA and Planned Contrast

Panel A: Conventional ANOVA

Source	df	MS	F-statistic	p-value
Framing (Negative vs. Positive)	1	1305.28	2.76	0.10
Risk quantification (No Quantification vs. Quantification)	1	1622.61	3.43	0.06
Framing × Risk quantification	1	314.91	0.67	0.42
Error	265	472.41		

Panel B: Planned Contrast

Source	df		F-statistic	p-value
Model contrast	1		6.24	0.01
Residual	2		0.30	0.74

Relative contrast variance residual $q^2 = 0.09$

Panel C: Simple Effects

Comparison	df		F-statistic	p-value
Negative vs. Positive (given No Quantification)	1		3.02	**0.04**
Negative vs. Positive (given Quantification)	1		0.36	0.55
Quantification vs. No Quantification (given Negative)	1		0.53	0.47
Quantification vs. No Quantification (given Positive)	1		3.63	**0.03**

Negative and Positive refer to the Framing of the RFD. No Quantification and Quantification refer to the Quantification of the risk impact on the firm's net income in case of materialization. Bolded p-values are **one-tailed**. The contrast code applies the following weights: Negative/No Quantification: -1, Negative/Quantification: -1, Positive/Quantification: -1, and Positive/No Quantification: +3. The p-value of the residual is not significant, indicating that the proposed contrast explains the systematic variation (Abelson and Prentice 1997). The relative contrast variance residual measures the proportion of between-group variance that is unexplained by the contrast Guggenmos et al. (2018). I compute a relative contrast variance residual of 0.09.

Ruling out alternative explanations

An alternative explanation for my results could be that quantifying the risk increases investors' perception of the risk of the investment. This could, in turn, reduce their willingness to invest, counteracting the effect of a positively framed RFD. In contrast to this conjecture, I

find that investors assess a higher likelihood of risk materialization when the risk is not quantified vis-à-vis when it is quantified (54.22 vs. 49.33, t_{267} = 2.00, p < 0.05, untabulated). Similarly, quantifying the risk does not influence how investors assess the riskiness of the investment (51.82 vs. 53.31, t_{267} = -0.63, p = 0.53, untabulated). This should rule out that an increased risk perception due to the risk quantification drives my results.

I argue that a positively framed RFD should evoke positive associations when investors encode the RFD's information, so that they perceive the risk as less threatening compared to a negatively framed RFD. While I find that a positively framed RFD leads investors to assess a directionally lower investment riskiness compared to a negatively framed RFD, this difference is not statistically significant (51.36 vs. 53.85, t_{267} = 1.06, p = 0.29, untabulated). A potential explanation is that investors consider the risk reported in the RFD (i.e., the raw material supply disruption) to be an inevitable standard risk of the firm's core business.[16] Notably, this works against finding support for my hypotheses. If investors do not perceive *a priori* the risk to be threatening for the firm, it is less likely that they would react to the RFD framing. That is, it would be less likely to find a significant interaction between the RFD framing and risk quantification. Nevertheless, I find evidence that a positively framed RFD may lead investors to perceive the risk as less threatening. Since I measure investment riskiness on a 101-point Likert scale (0 = not at all risky, 100 = very risky), I test investors' mean assessments against the 50-midpoint. I assume the 50-midpoint score indicates an average level of investment riskiness. Investors provided with a negatively framed RFD assess a higher investment riskiness than the 50-midpoint score (53.85 vs. 50, t_{131} = 2.33, p = 0.02, untabulated). In contrast, investors provided with a positively framed RFD assess an equivalent investment riskiness to the 50-midpoint score (51.36 vs. 50, t_{136} = 0.81, p = 0.42, untabulated).

---

[16] The firm's core business is to provide customers with high-quality products produced from sustainable raw materials sourced worldwide.

It is reassuring to note, however, that my hypotheses predict an effect of RFD framing on investors' willingness to invest and not on their risk perceptions.

Another alternative explanation may be that investors doubt that the management can estimate the risk reliably. This implies that quantifying the risk could make investors question the management's competence and/or the disclosure reliability. This may reduce investors' willingness to invest and counteract the effect of a positively framed RFD. However, quantifying the risk does not appear to affect how investors assess management's competence (73.93 vs. 75.96, $t_{267} = 0.94$, $p = 0.35$, untabulated) or the reliability of the RFD (73.66 vs. 75.94, $t_{267} = 1.05$, $p = 0.30$, untabulated). This shows that the effect of risk quantification on investors' assessment of management's competence and disclosure reliability does not drive my results.

V. CONCLUSIONS

I investigate whether quantifying the risk may work as a remedy for the RFD framing effect on investors' willingness to invest. I hypothesize that quantifying the risk may prevent investors from assessing a higher willingness to invest for a firm reporting a positively framed RFD compared to a negatively framed RFD *ceteris paribus*. Drawing on the attribute framing theory and the persuasion knowledge model, I predict and find that, when the risk is not quantified, investors assess a higher willingness to invest in a firm reporting a positively framed RFD relative to a negatively framed RFD. However, quantifying the risk in the RFD appears to counteract the effect of a positively framed RFD. Quantifying the risk leads investors to assess an equivalent willingness to invest in firms reporting either positively framed or negatively framed RFDs. Moreover, quantifying the risk does not affect investors' willingness to invest when the RFD is negatively framed. In line with the framing literature (Levin et al. 1998), my results suggest that investors fall prey to a positively framed RFD when they must base their judgments on the qualitative description of the risk. Importantly, I show that

quantifying the risk may be an effective way to prompt investors to see through a positively framed RFD and counteract its effect.

My study offers interesting implications. My findings and those of Tan and Yeo (2023) suggest that RFD framing is a multifaceted phenomenon worth further investigation. I show that investors may benefit from the risk quantification in the RFD to counter the framing effect. Notably, quantifying the risk does not appear to have undesirable effects on investors. If managers are cautious and frame the RFD negatively, quantifying the risk does not seem to influence investors' willingness to invest. On the other hand, if managers frame the RFD positively to increase investors' willingness to invest, quantifying the risk allows investors to de-bias their judgment from the positive framing effect. This evidence could help regulators to decide whether to require or encourage the quantification of risk. Nevertheless, it is safe to assume that preparers aware of these findings who intend to frame the RFD positively would be reluctant to quantify the risk voluntarily. Furthermore, mandating firms to quantify the risk could also address the concerns that the RFD is becoming lengthy, boilerplate, and less informative (Beatty et al. 2019; SEC 2020). Quantifying the risk is arguably costly, which should lead managers to disclose and quantify only relevant risks. Even though risk measures reporting expected losses should be the most useful (UNCTAD 2017), regulators must also gauge whether firms can reliably quantify risks. If regulators conclude that only larger firms can do so, they might decide to encourage firms to quantify risks while leaving it a voluntary choice. Finally, this study should help investors gain awareness of their own judgment bias. I show that simply framing the RFD positively can increase investors' willingness to invest despite identical underlying economics and risk exposure. Hopefully, this will help investors be more skeptical when reading a RFD that sounds too good.

My study is not without limitations, which offers opportunities for future research. I do not explicitly inform investors that quantifying the risk is voluntary. This design choice

allows me to isolate the effect of risk quantification. If I had informed investors that quantifying the risk was a voluntary disclosure choice, it would have also influenced their perception of management's credibility (see Cortese and Kunz 2024). Conversely, I wanted to investigate whether risk quantification *per se* is a remedy for the effect of a positively framed RFD, abstracting from investors' considerations about the management. Another relevant design choice was quantifying the risk as a single-point estimate. Future studies may test how quantifying the risk as a range of possible outcomes could affect my results. Finally, investors in my study seem to perceive an investment in the firm as moderately risky. It could be interesting to test how investors would respond to RFDs conveying a higher and lower investment riskiness, respectively.

REFERENCES

Abelson, R.P., and D.A. Prentice. 1997. Contrast Tests of Interaction Hypotheses. *Psychological Methods* 2 (4): 315-328.

Anderson, U., K. Kadous, and L. Koonce. 2004. The Role of Incentives to Manage Earnings and Quantification in Auditors' Evaluations of Management-Provided Information. *Auditing: A Journal of Practice & Theory* 23 (1): 11-27.

Ang, N.P., and K.T. Trotman. 2015. The Utilization of Quantitative and Qualitative Information in Groups' Capital Investment Decisions. *Behavioral Research in Accounting* 27 (1): 1-24.

Asay, S.H., and J. Hales. 2018. Disclaiming the Future: Investigating the Impact of Cautionary Disclaimers on Investor Judgments Before and After Experiencing Economic Loss. *The Accounting Review* 93 (4): 81-99.

Ballou, B., D.L. Heitger, and D. Stoel. 2011. How Boards of Directors Perceive Risk Management Information. *Management Accounting Quarterly* 12 (4): 14–22.

Beatty, A., L. Cheng, and H. Zhang. 2019. Are Risk Factor Disclosures Still Relevant? Evidence from Market Reactions to Risk Factor Disclosures Before and After the Financial Crisis. *Contemporary Accounting Research* 36 (2): 805-838.

Bedard, J.C., and L.E. Graham. 2002. The Effects of Decision Aid Orientation on Risk Factor Identification and Audit Test Planning. *Auditing: A Journal of Practice & Theory* 21 (2): 39-56.

Buckless, F.A., and S. P. Ravenscroft. 1990. Contrast Coding: A Refinement of ANOVA in Behavioral Analysis. *The Accounting Review* 65 (4): 933–945.

Campbell, J.L., H. Chen, D.S. Dhaliwal, H. Lu, and L.B. Steele. 2014. The information content of mandatory risk factor disclosures in corporate filings. *Review of Accounting Studies* 19: 396-455.

CFA Institute. 2014. The SEC's Disclosure Effectiveness Initiative. Available at: http://www.cfainstitute.org/-/media/documents/comment-letter/2010-2014/20141112.ashx (last accessed October 1, 2024).

Cortese, A., and A.H. Kunz. 2024. What's in a Number? Voluntary Quantification of Risk Factor Disclosures and Investors' Perceptions of Risk, Management's Credibility, and Disclosure Usefulness. Working Paper, University of Bern.

Davis, A.K., J.M. Piger, and L.M. Sedor. 2012. Beyond the Numbers: Measuring the Information Content of Earnings Press Release Language. *Contemporary Accounting Research* 29 (3): 845-868.

Durney, M.T., J. Smith, and M.J. Wynes. 2024. Connecting the Dots: Helping Investors Use Risk Disclosures When Evaluating Financial Statements. Available at: https://ssrn.com/abstract=3947286 (last accessed September 10, 2024).

Eilifsen, A., E.L. Hamilton, and W.F. Messier, Jr. 2021. The importance of quantifying uncertainty: Examining the effects of quantitative sensitivity analysis and audit materiality disclosures on investors' judgments and decisions. *Accounting, Organizations and Society* 90: Article 101169.

Emby, C. 1994. Framing and Presentation Mode Effects in Professional Judgment: Auditors' Internal Control Judgments and Substantive Testing Decisions. *Auditing: A Journal of Practice & Theory* 13 (1) (Supplement): 102-115.

Emby, C., and D. Finley. 1997. Debiasing Framing Effects in Auditors' Internal Control Judgments and Testing Decisions. *Contemporary Accounting Research* 14 (2): 55-77.

Feldman, R., S. Govindaraj, J. Livnat, and B. Segal. 2010. Management's tone change, post earnings announcement drift and accruals. *Review of Accounting Studies* 15: 915-953.

Friestad, M., and P. Wright. 1994. The Persuasion Knowledge Model: How People Cope with Persuasion Attempts. *Journal of Consumer Research* 21 (1): 1-31.

Guggenmos, R.D., D.M. Piercey, and C. P. Agoglia. 2018. Custom Contrast Testing: Current Trends and a New Approach. *The Accounting Review* 93 (5): 223-244.

Hamilton, E.L., and J. Winchel. 2019. Investors' Processing of Financial Communications: A Persuasion Perspective. *Behavioral Research in Accounting* 31 (1): 133-156.

Hanley, K.W., and G. Hoberg. 2010. The Information Content of IPO Prospectuses. *The Review of Financial Studies* 23 (7): 2821-2864.

He, Y., H. Tan, F. Yeo, and J. Zhang. 2019. When Do Qualitative Risk Disclosures Backfire? The Effects of a Mismatch in Hedge Disclosure Formats on Investors' Judgments. *Contemporary Accounting Research* 36 (4): 2093-2112.

Hope, O-K., D. Hu, and H. Lu. 2016. The benefits of specific risk-factor disclosures. *Review of Accounting Studies* 21: 1005-1045.

Huang, X., S.H. Teoh, and Y. Zhang. 2014. Tone Management. *The Accounting Review* 89 (3): 1083-1113.

Joe, J.R., S.D. Vandervelde, and Y. Wu. 2017. Use of High Quantification Evidence in Fair Value Audits: Do Auditors Stay in their Comfort Zone? *The Accounting Review* 92 (5): 89-116.

Kadous, K., L. Koonce, and K.L. Towry. 2005. Quantification and Persuasion in Managerial Judgement. *Contemporary Accounting Research* 22 (3): 643-686.

Kahneman, D. 2003. Maps of Bounded Rationality: Psychology for Behavioral Economics. *The American Economic Review* 93 (5): 1449-1475.

Koonce, L., and M.G. Lipe. 2010. Earnings Trend and Performance Relative to Benchmarks: How Consistency Influences Their Joint Use. *Journal of Accounting Research* 48 (4): 859–884.

Koonce, L., and M.G. Lipe. 2017. Firms with Inconsistently Signed Earnings Surprises: Do Potential Investors Use a Counting Heuristic? *Contemporary Accounting Research* 34 (1): 292–313.

Koonce, L., C. Mongold, L. Quaid, and B.J. White. 2024. Experimental research on standard-setting issues in financial reporting. *Accounting, Organizations and Society* 112: Article 101509.

Kothari, S.P., X. Li, and J.E. Short. 2009. The Effect of Disclosures by Management, Analysts, and Business Press on Cost of Capital, Return Volatility, and Analyst Forecasts: A Study Using Content Analysis. *The Accounting Review* 84 (5): 1639-1670.

Kravet, T. and V. Muslu. 2013. Textual risk disclosures and investors' risk perceptions. *Review of Accounting Studies* 18: 1088-1122.

Levin, I.P. 1987. Associative effects of information framing. *Bulletin of the Psychonomic Society* 25 (2): 85-86.

Levin, I.P., and G.J. Gaeth. 1988. How Consumers Are Affected by the Framing of Attribute Information Before and After Consuming the Product. *Journal of Consumer Research* 15 (3): 374-378.

Levin, I.P., S.L. Schneider, and G.J. Gaeth. 1998. All Frames Are Not Created Equal: A Typology and Critical Analysis of Framing Effects. *Organizational Behavior and Human Decision Processes* 76 (2): 149-188.

Li, F. 2010. The Information Content of Forward-Looking Statements in Corporate Filings – A Naïve Bayesian Machine Learning Approach. *Journal of Accounting Research* 48 (5): 1049-1102.

Lin, T.C.W. 2016. Concept Release on Business and Financial Disclosure Required by Regulation S-K (File No. S7-06-16, Release Nos. 33 10064, 34-77599). Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwj70JDV4ufzAhXR4KQKHdWoBAAQFnoECAUQAQ&url=https%3A%2F%2Fwww.sec.gov%2Fcomments%2Fs7-06-16%2Fs70616-146.pdf&usg=AOvVaw2PncAkWFSO5FFWnHV6hJt4 (last accessed October 1, 2024).

Loraas, T. 2009. The effects of quantification on persuasion in unfamiliar contexts: The case of information systems controls. *Advances in Accounting, incorporating Advances in International Accounting* 25 (1): 49-56.

Maksymov, E.M., M.W. Nelson, and W.R. Kinney, Jr. 2018. Budgeting Audit Time: Effects of Audit Step Frame and Verifiability. *Behavioral Research in Accounting* 30 (1): 59-73.

Marks, H. 2022. Talks at GS 2022. Available at: https://de.slideshare.net/gangesh/transcriptpdf-252537706 (last accessed March 6, 2024).

Mondelez International, Inc. 2023. *Form 10-K.* Available at: https://ir.mondelezinternational.com/static-files/0338fef7-1359-4edc-aa79-f2ca60254cf4 (last accessed May 28, 2024).

Netflix, Inc. 2023. *Form 10-K.* Available at: https://d18rn0p25nwr6d.cloudfront.net/CIK-0001065280/c5e64982-659f-4726-97c9-c57767c3bec3.pdf (last accessed May 28, 2024).

Nunnally, J.C., and I.H. Bernstein. 1994. *Psychometric Theory*. Third Edition. New York, NY, USA: McGraw-Hill.

Securities and Exchange Commission (SEC). 1997. *Disclosure of Accounting Policies for Derivative Financial Instruments and Derivative Commodity Instruments and Disclosure of*

Quantitative and Qualitative Information about Market Risk Inherent in Derivative Financial Instruments, Other Financial Instruments, and Derivative Commodity Instruments. Final rules. Release Nos. 33-7386; 34-38223; IC-22487; FR-48; International Series No. 1047; File No. S7-35-95. Washington, D.C. Available at: https://www.sec.gov/files/rules/final/33-7386.txt (last accessed August 8, 2024).

Securities and Exchange Commission (SEC). 2005. *Securities Offering Reform.* Final rule. Release Nos. 33-8591; 34-52056; IC-26993; FR-75; International Series Release No. 1294; File No. S7-38-04. Washington, D.C. Available at: https://www.sec.gov/files/rules/final/33-8591.pdf (last accessed October 14, 2024).

Securities and Exchange Commission (SEC). 2016. *Business and Financial Disclosure Required by Regulation S-K.* Concept release. Release No. 33-10064; 34-77599; File No. S7-06-16. Washington, D.C. Available at: https://www.sec.gov/files/litigation/litreleases/2016/33-10064.pdf (last accessed October 14, 2024).

Securities and Exchange Commission (SEC). 2020. *Modernization of Regulation S-K Items 101, 103, and 105*. Final rule. Release Nos. 33-10825; 34-89670; File No. S7-11-19. Washington, D.C. Available at: https://www.sec.gov/files/rules/final/2020/33-10825.pdf (last accessed October 14, 2024).

Stoel, D.M., B. Ballou, and D.L. Heitger. 2017. The Impact of Quantitative versus Qualitative Risk Reporting on Risk Professionals' Strategic and Operational Risk Judgments. *Accounting Horizons* 31 (4): 53–69.

Tan, H., E.Y. Wang, and B. Zhou. 2014. When the Use of Positive Language Backfires: The Joint Effect of Tone, Readability, and Investor Sophistication on Earnings Judgments. *Journal of Accounting Research* 52 (1): 273-302.

Tan, H., and F. Yeo. 2023. You have been forewarned! The effects of risk management disclosures and disclosure tone on investors' judgments. *Accounting, Organizations and Society* 105: Article 101400.

Thompson, V.A., J.A. Prowse Turner, and G. Pennycook. 2011. Intuition, reason, and metacognition. *Cognitive Psychology* 63 (3): 107-140.

United Nations Conference on Trade and Development (UNCTAD). 2017. The role of disclosure in risk assessment and enhancing the usefulness of corporate reporting in

decision-making. Available at: https://unctad.org/system/files/official-document/ciiisard82_en.pdf (last accessed October 10, 2024).

U.S. House of Representatives. 1995. Private Securities Litigation Reform Act of 1995. Pub. L. No. 104-67 [H.R. 1058]. Conference Report No. 369, 104th Congress, 1st Session. Washington, D.C. Available at: https://www.congress.gov/104/crpt/hrpt369/CRPT-104hrpt369.pdf (last accessed October 14, 2024).

Wang, K. 2021. Is the Tone of Risk Disclosures in MD&As Relevant to Debt Markets? Evidence from the Pricing of Credit Default Swaps. *Contemporary Accounting Research* 38 (2): 1465-1501.

APPENDIX A

Real-World Excerpts of Risk Factor Disclosures

Mondelez International, Inc., Form 10-K, 2023

Strategic and Operational Risks

Commodity and other input prices are volatile and may increase or decrease significantly or availability of commodities may become constrained.

We purchase and use large quantities of commodities, including cocoa, dairy, wheat, edible oils, sugar and other sweeteners, flavoring agents and nuts. In addition, we purchase and use significant quantities of product packaging materials, natural gas, fuel and electricity for our factories and warehouses, and we also incur expenses in connection with labor and the transportation and delivery of our products. Costs of raw materials, energy and other supplies and services are volatile and fluctuate due to conditions that are difficult to predict. These conditions include global competition for resources; currency fluctuations; geopolitical conditions or conflicts (including the ongoing war in Ukraine and international sanctions imposed on Russia for its invasion of Ukraine, developments in the Middle East and rising tensions between China and Taiwan); inflationary pressures related to domestic and global economic conditions or supply chain issues; transportation and labor disruptions; tariffs or other trade barriers; government intervention to introduce living income premiums or similar requirements such as those announced in 2019 in two of the main cocoa-growing countries; changes in environmental or trade policy and regulations, alternative energy and agricultural programs; severe weather; agricultural productivity; crop disease or pests; water risk; health pandemics; forest fires and other natural disasters; acts of terrorism; cybersecurity incidents; supplier capacity; and consumer or industrial demand. Many of these conditions are or could be exacerbated or worsened by climate change. Increased government intervention and consumer or activist responses caused by increased focus on climate change, deforestation, water, plastic waste, animal welfare and human rights concerns and other risks associated with the global food system could adversely affect our or our suppliers' reputation and business and our ability to procure the materials we need to operate our business. Some commodities are grown by smallholder farmers who might not be able to invest to increase productivity or adapt to changing conditions. Our work to monitor our exposure to commodity prices and hedge against input price increases cannot fully protect us from changes in commodity costs due to factors like market illiquidity, specific local regulations and downstream costs. Thus, our hedging strategies have not always protected and will not in the future always protect us from increases in specific raw material costs. Continued volatility in the prices of commodities and other supplies we purchase or changes in the types of commodities we purchase as we continue to evolve our product and packaging portfolio could increase or decrease the costs of our products, and our profitability could suffer as a result. Moreover, increases in the price of our products, including increases to cover inflation and higher input, packaging and transportation costs, may result in lower sales volumes or customer delistings, while decreases in input costs could require us to lower our prices and thereby affect our revenues, profits or margins. Likewise, constraints in the supply or availability of key commodities and necessary services like transportation, such as we experienced across our business, particularly in the United States and United Kingdom, may limit our ability to grow our net revenues and earnings. If our mitigation activities are not effective, if we are unable to price to cover increased costs (including if we are delayed in our ability to raise prices or unable to raise the prices of our products enough to keep up with the rate of inflation), if we must reduce our prices, if increased prices affect demand for our products (including if consumers forego purchasing certain of our products or switch to "private label" or lower-priced product offerings), or if we are limited by supply or distribution constraints, our financial condition, results of operations, cash flows and stock price can be materially adversely affected.

Netflix, Inc., Form 10-K, 2023

Risks Related to Our Business

If our efforts to attract and retain members are not successful, our business will be adversely affected.

We must continually add new members both to replace canceled memberships and to grow our business beyond our current membership base. Our penetration and growth rates have fluctuated and vary across the jurisdictions where we provide our service. In countries where we have been operating for many years or where we are highly penetrated, our membership growth is slower than in newer or less penetrated countries. Our ability to continue to attract and retain members will depend in part on our ability to consistently provide our members in countries around the globe with compelling content choices that keep our members engaged with our service, effectively drive conversation around our content and service, as well as provide a quality experience for choosing and enjoying TV series, films and games. Furthermore, the relative service levels, content offerings, pricing and related features of competitors to our service may adversely impact our ability to attract and retain members. Competitors include other entertainment video providers, such as linear television, and streaming entertainment providers (including those that provide pirated content), video gaming providers, as well as user-generated content, and more broadly other sources of entertainment that our members could choose in their moments of free time.

Members cancel our service for many reasons, including a perception that they do not use the service sufficiently, that they need to cut household expenses, dissatisfaction with content, a preference for competitive services and customer service issues that they believe are not satisfactorily resolved. Membership growth is also impacted by seasonality, with the fourth quarter historically representing our greatest growth, as well as the timing of our content release schedules. Adverse macroeconomic conditions, including inflation, may also adversely impact our ability to attract and retain members. If we do not grow as expected, given, in particular, that our content costs are largely fixed in nature, we may not be able to adjust our expenditures or increase our (per membership) revenues, including by adjusting membership pricing, commensurate with the lowered growth rate such that our margins, liquidity and results of operations may be adversely impacted. If we are unable to successfully compete with current and new competitors in providing compelling content, retaining our existing members and attracting new members, our business will be adversely affected.

APPENDIX B

Framing manipulation[17]

[Negative]

Risk of raw material supply disruption

We rely on the supply of organic raw materials from third-party producers located in different world areas, where optimal weather conditions are crucial to ensure a sufficient production of raw materials for our needs. In fact, **a disruption** in the supply of raw material from current sources **will disrupt** our production. We do not have control over our suppliers. In the event of disruption, our production may **be discontinued** if we **do not have the ability** to locate alternative raw material suppliers, as they may be **incomparable** in quality or offer **unacceptable** prices. **Delays, interrupted** raw materials supply at **unreasonable** costs **could lead us to fail** to meet customer demand for our products, **damage** our branding and **suffer financial losses**.

[Positive]

Risk of raw material supply disruption

We rely on the supply of organic raw materials from third-party producers located in different world areas, where optimal weather conditions are crucial to ensure a sufficient production of raw materials for our needs. In fact, **a constant** supply of raw materials from current sources **is needed to maintain** our production. We do not have control over our suppliers. In the event of disruption, our production may **only continue** if we **have the ability** to locate alternative raw material suppliers that are **comparable** in quality and offer **acceptable** prices. **Timely, uninterrupted** raw materials supply at **reasonable** costs **are needed for us** to meet customer demand for our products, **uphold** our branding and enjoy **financial profitability**.

Risk quantification manipulation

[No Quantification]

Participants in the No Quantification condition did not view any additional sentence.

[Quantification]

Participants in the Quantification conditions viewed the following additional and concluding sentence in the RFD:

In case of a raw material supply disruption, we expect a negative impact on the net income of 225 million $.

---

[17] The framing manipulation is based on Tan and Yeo (2023).

ESSAY 2

Do Investors Understand Firms' Market Risk Disclosures? The Effect of Risk Format and Uncertainty on Investment Willingness

Alessandro Cortese

University of Bern

ABSTRACT: Regulators grant firms significant flexibility when reporting the market risk disclosure by allowing different risk formats, such as the sensitivity analysis (SA-format) and the Value-at-Risk (VaR-format) (SEC 1997a). I investigate whether investors understand these risk formats. Due to different estimation methods, the informativeness of the risk formats varies depending on the degree of uncertainty (uncertainty). Unlike the SA-format, the estimation of the VaR-format relies on historical data. Thus, the VaR-format is less informative than the SA-format when uncertainty is high because historical data are unreliable. Failing to understand this may have unintended effects when investors assess an investment in the firm. I examine the effect of the risk format (SA-format vs. VaR-format) and the uncertainty (low vs. high) on investors' willingness to invest. I predict and find that investors do not understand that the risk formats are differently informative depending on uncertainty. Consistent with my theory, I find evidence suggesting that investors use the risk format's perceived sophistication as a substitute attribute to infer its informativeness, disregarding uncertainty. Given high uncertainty, investors erroneously assess a higher willingness to invest in the firm reporting the less informative VaR-format relative to the more informative SA-format. Since managers can freely choose which risk format to report, I show that management's credibility mediates the effect of the risk format and uncertainty on investors' willingness to invest. My study shows that the market risk disclosure can mislead investors, as they do not understand its risk formats. My findings represent useful evidence to the current debate on disclosure flexibility encouraged by the SEC (2016).

KEYWORDS: *risk disclosure, Value-at-Risk, sensitivity analysis, SEC, 10-K, risk format, uncertainty.*

I. INTRODUCTION

The Securities and Exchange Commission (SEC) requires registrants (firms) to report the market risk disclosure (SEC 1997a). Firms disclose their exposure to market risk factors (e.g., interest rates) to help investors assess their riskiness.[1] Firms can choose between different market risk disclosure formats (risk formats), such as the sensitivity analysis (SA-format) and the Value-at-Risk (VaR-format) (SEC 1997a). The SA-format reports the expected loss given an adverse 10% change in the reported market factor. Importantly, however, the SA-format does not state the probability of the market factor change (Hodder, Koonce, and McAnally 2001). Conversely, the VaR-format reports the worst-case loss due to a change in a market factor estimated with a 95% probability (i.e., a larger loss has a 5% probability to occur).[2]

The two risk formats are not comparable because their estimation methods differ (Hodder et al. 2001; Hodder and McAnally 2001). The VaR-format estimates the worst-case loss assuming that future market conditions will not significantly differ from past market conditions (Linsmeier and Pearson 2000). In contrast, the SA-format simply computes the expected loss by assuming a pre-determined market factor change (SEC 1997a). Importantly, due to the different estimation methods, the informativeness of the risk formats systematically varies depending on the degree of uncertainty (uncertainty).[3] The VaR-format assumes that past market conditions will replicate in the future. This is, however, very unlikely when uncertainty is high, as market factors might fluctuate significantly. Thus, past market conditions are not a reliable basis for estimating the expected loss via the VaR-format when

---

[1] The market factors include interest rates, foreign currency exchange rates, commodity prices, and other relevant market rates or prices (SEC 1997a).

[2] The SEC allows to report the risk impact also in terms of cash flows or fair values. I focus on earnings loss because it is arguably easier for nonprofessional investors to understand the risk implications for the firm. Regulators also allow the tabular format, which only reports fair values. My study does not focus on the tabular format because it appears the least relevant in practice. A manual analysis of a sample of S&P500 firms shows that only 5% of the market risk factors were reported in the tabular format.

[3] As low (high) uncertainty I indicate a period where market factors are not expected to fluctuate (are expected to strongly fluctuate), so that future market conditions will not (will) differ from past market conditions.

uncertainty is high. Contrarily to the VaR-format, the SA-format completely abstracts from past market conditions. Therefore, when uncertainty is high, the VaR-format is less informative than the SA-format. Conversely, when uncertainty is low, future market conditions should not differ from past ones, so that the VaR-format can rely on past market conditions to estimate the expected loss. This means that the VaR-format is more informative than the SA-format when uncertainty is low. While the VaR-format reliably estimates the worst-case loss with a 95% probability, the SA-format is less informative because a 10% market factor change is very unlikely when uncertainty is low. However, it remains an open question whether nonprofessional investors *understand* that the risk formats' informativeness depends on uncertainty. I investigate in an experiment whether investors understand the interplay between uncertainty and risk formats and how their (mis)understanding of this interplay affects their willingness to invest. If investors are rational and understand that the firm deliberately reported the less informative risk format, they should react by assessing a lower willingness to invest. This is so because reporting the less informative risk format is a cue for investors. Investors would interpret this cue as a signal that the management is not credible as managers do not choose to disclose the firm's risk exposure transparently. Therefore, it is important to investigate this research question because *misunderstanding* the risk formats could lead investors to erroneous investment assessments.

I hypothesize that investors employ a simple heuristic to process the risk formats. Drawing on the attribute substitution theory (Kahneman and Frederick 2002), I posit that investors use the perceived sophistication of a risk format to infer its informativeness. I predict that investors perceive the VaR-format as more sophisticated and more informative than the SA-format *independent* of uncertainty. Since individuals prefer simplified and easy-to-elaborate information (Chater and Lowenstein 2016), investors should assess the VaR-format as more sophisticated than the SA-format because the VaR-format reports the worst-case loss

with a high probability. Conversely, the SA-format does not provide a probability associated with the expected loss. This makes it more difficult for investors to use this information when assessing a potential investment in the firm. Consequently, they should perceive the SA-format as less sophisticated relative to the VaR-format.

Importantly, using the risk format's perceived sophistication to infer its informativeness will mislead investors. Investors will not understand that the VaR-format is less informative than the SA-format when uncertainty is high. Consequently, when uncertainty is high, I expect investors to erroneously assess a higher willingness to invest when the firm reports the less informative VaR-format vis-à-vis the more informative SA-format. Conversely, when uncertainty is low, investors are likely to perceive the risk as negligible. If investors judge the risk as too unlikely to materialize, the reported risk format should not affect their willingness to invest. Furthermore, since the management is free to choose the risk format to report, I hypothesize that investors' perception of management's credibility mediates the effect of risk formats on their willingness to invest, but *only* when uncertainty is high. Investors assess managers as more credible when disclosing the information that makes them more vulnerable (Hodge, Hopkins, and Pratt 2006). When uncertainty is high, it is likely that market factor fluctuations will negatively affect the firm. Given that investors erroneously believe the VaR-format to be more informative relative to the SA-format, they will assess the management as more credible when reporting the VaR-format. In turn, I posit that higher management's credibility increases investors' willingness to invest in the firm.

To test my hypotheses, I design a 2x2 between-subject experiment. An experiment is particularly suitable to address my research question because I can exogenously manipulate uncertainty, thereby avoiding endogeneity issues typical for archival studies (see e.g., Amiram, Landsman, Owens, and Stubben 2018; Loh and Stulz 2018; Bochkay and Joos 2021). I operationalize the risk format as a risk format *change* to rule out the confounding effect of

disclosure stickiness.[4] This design choice avoids that investors believe that the reported risk format is not a considered disclosure choice but a simple repetition of the prior year's disclosure. As disclosure stickiness could unpredictably affect investors, the risk format change provides a cleaner test of my theory. I manipulate the direction of the risk format change (change from VaR- to SA-format vs. change from SA- to VaR-format) and the degree of uncertainty (low uncertainty vs. high uncertainty). To ensure an adequate level of knowledge, I educate participants on the features of the risk formats.[5] Participants assume the role of potential investors and are asked to assess the sophistication and informativeness of the risk formats, the management's credibility, and their willingness to invest in the firm.

My results suggest that investors generally perceive the VaR-format as more sophisticated and more informative than the SA-format. Since they use a risk format's perceived sophistication to infer its informativeness, they fail to understand that the VaR-format is less informative than the SA-format when uncertainty is high. This misunderstanding appears to affect how investors assess a potential investment. Given high uncertainty, investors erroneously assess a higher willingness to invest for the firm reporting the less informative VaR-format compared to the more informative SA-format. Conversely, when uncertainty is low, investors' willingness to invest does not differ, whether the firm reports the VaR-format or the SA-format. Additionally, I find evidence that investors' perception of management's credibility mediates the effect of the risk format on investment willingness. When uncertainty is high, investors provided with the VaR-format (SA-format) assess a higher (lower) management's credibility, which in turn increases (decreases) their willingness to invest. As predicted, I do not find support for this mediation when uncertainty is low.

---

[4] Dyer, Lang, and Stice-Lawrence (2017, p. 224) define disclosure stickiness as "*re-use of the same firm's disclosure from a prior period*". This design choice works against my hypotheses. Changing the risk format makes it more salient and elicits investors to actively think about it. This increases the likelihood that investors will understand that the risk format's informativeness depends on uncertainty.

[5] Participants read the informational material and can only access the experiment if they correctly answer the quiz questions (see "Method" section for more detailed information).

I contribute to the literature by investigating whether the risk formats can mislead investors. I also provide new evidence to the experimental accounting research on uncertainty (e.g., Kelton and Montague 2018; Eilifsen, Hamilton, and Messier 2021; Cannon 2015; Clor-Proell 2009) and management's credibility (e.g., Hodge et al. 2006; Mercer 2004; 2005). Moreover, this study answers the SEC's (2016) call for evidence on whether the allowed risk formats require standardization.

My findings have important implications. They show that investors systematically misunderstand the risk formats, which leads them to erroneous investment assessments. This is problematic because risk disclosures should enable investors to better understand a firm's risk exposure, especially in an unstable economic context. My findings are of interest to regulators, as they suggest that standardizing the risk formats could help investors. Reducing the risk formats' diversity may avoid that investors are paradoxically more willing to invest in firms disclosing their risk exposure less transparently. Finally, I also show that the risk format choice has relevant implications for managers, affecting how investors perceive their credibility.

The remainder of the paper is structured as follows: In section II, I present background information, theory, and hypotheses. In section III, the method is illustrated. I discuss the results in section IV, and section V concludes.

II.   BACKGROUND, THEORY, AND HYPOTHESES

SEC Financial Reporting Release 48

In 1997, the SEC introduced the market risk disclosure with the Financial Reporting Release 48 (FR-48), consisting in the forward-looking disclosure of a firm's exposure to market risks, such as interest rates, foreign exchange rates, and commodity prices (SEC 1997a, see Appendix A for examples). The FR-48 aims to improve the disclosure of financial instruments sensitive to market risks, such as derivative financial instruments, derivative commodity

instruments, investments, loans, mortgage-backed securities, or indexed debt instruments (Elmy, LeGuyader, and Linsmeier 1998; Roulstone 1999). Firms can choose between the VaR-format or the SA-format to disclose the expected earnings loss in case of risk materialization. Similarly, the IASB requires firms to disclose their market risks with the SA-format or the VaR-format (IFRS 7).

The SA-format reports the expected loss occasioned by a hypothetical change in the reported market factor. The hypothesized change should amount to 10% if not otherwise justified (SEC 1997a).[6] The VaR-format reports the worst-case loss due to a change in the reported market factor estimated with a minimum 95% probability unless otherwise justified (SEC 1997a). Firms are allowed to change the risk format between years for a particular market risk (SEC 1997b).[7] The SEC provided firms with significant flexibility regarding the risk formats instead of enforcing standardization (SEC 2016). Regulators argue that the risk formats should "accommodate different types of registrants, different degrees of market risk exposure, and alternative ways of measuring market risk" (SEC 2016, p. 159).

The market risk disclosure has become growingly prominent in firm's financial reporting, with its length increasing from 1999 to 2016 (Lobo, Siqueria, Tam, and Zhou 2019). Archival research suggests that the market risk disclosure benefits investors because it reduces uncertainty and the diversity of opinions among investors (Linsmeier, Thornton, Venkatachalam, and Welker 2002). Similarly, a higher quality of the market risk disclosure is associated with a lower future variability of cash flow (Lobo et al. 2019). Banks disclosing the VaR-format provide useful information to evaluate their risk profile (Jorion 2002). The

---

[6] While it is allowed to hypothesize a different market factor change, many firms do not appear to do so. The SEC (2016) noted that many firms used the 10% market factor change despite the prolonged period of lower interest rates.

[7] The SEC (1997b) explains that firms should disclose the reasons of the risk format change and provide comparable information: "For example, if a company used a sensitivity analysis for its interest rate sensitive trading portfolio in prior years and adopts VAR to report the same exposure in the current year, it must present comparable information for the prior year. This can be accomplished in either of two ways. The company may present comparable VAR information for both years, or it may present sensitivity analyses for both years, along with the current VAR information".

experimental literature, on the other hand, shows that risk disclosures can have unintended effects on investors. Fanning, Agoglia, and Piercey (2015) provide evidence that adding low-probability risks to a disclosure leads investors to assess a lower overall risk while it is actually higher. Similarly, a SA-format disclosing only potential losses leads investors to assess low-frequency events as highly probable, whereas disclosing potential losses and gains eliminates this effect (Koonce, Lipe, and McAnally 2005). Prior research also shows that the management's choice of the numerical format in a SA-format affects investors' risk assessment (Nelson and Rupar 2015). Taken together, prior literature presents mixed results on the benefits of risk disclosures. While archival findings seem more optimistic, the experimental literature cautions that the features of the risk formats may mislead investors. In this study, I investigate whether failing to understand the specific features of the VaR- and SA-format may have unintended consequences on investors' judgments.

Risk format and uncertainty

Investors must understand the estimation methods of the risk formats to properly use their information when assessing an investment. Forward-looking information is "uncertain and often unverifiable, even when made in good faith" (Asay and Hales 2018, p. 83). Thus, the differences in the estimation methods make it even more difficult to assess the informativeness of the risk formats. The SA-format reports the expected loss assuming a 10% market factor change. It does not seem informative at face value since it does not report an associated probability with the factor change. The VaR-format provides the worst-case loss estimated with a 95% probability. It appears very informative at first because the expected loss is associated with a very high probability. Nevertheless, its estimation method has limitations. Linsmeier and Pearson (2000) emphasize that the VaR-format is a summary statistic of the hypothesized outcome distribution, which depends on the estimation assumptions. Given that the VaR-format estimation is based on historical data (Linsmeier and Pearson 2000), future market

conditions are expected to reflect past market conditions. In contrast, the SA-format estimation does not rely on historical data. It simply assumes a pre-specified market risk factor change and computes the expected loss.

These differences between the estimation methods result in the informativeness of each risk format to depend on uncertainty. This is important for investors to understand because the global economy is characterized by cyclical periods of low and high uncertainty (Bloom, Ahir, and Furceri 2022). High uncertainty is associated with financial crises, (trade) wars, supply chain disruptions, pandemics, and sovereign debt crises (Bloom et al. 2022), where predicting how market factors will change is very difficult. This implies that the VaR-format is less informative when uncertainty is high, as future market conditions will likely differ from past ones.[8] Conversely, the SA-format discloses the expected loss associated with a pre-determined market factor change. Given that its estimation does not rely on past market conditions, the SA-format is relatively more informative than the VaR-format when uncertainty is high. On the other hand, when uncertainty is low, the VaR-format is more informative. Past market conditions are a reliable indicator for the VaR-format estimation, as in a low uncertainty context future market conditions should not differ from past ones. Therefore, the VaR-format's worst-case loss is reliably estimated with a very high probability. In contrast, the SA-format is less informative because a 10% market factor change is very unlikely to occur when uncertainty is low.

Rational investors should understand that the informativeness of the risk formats differently depends on uncertainty. Thus, once informed about the uncertainty, they would know whether the firm reported the more or less informative risk format. Since managers can freely choose the risk format, investors can use the reported risk format as a cue for

---

[8] See Linsmeier and Pearson (2000; 1997) for an overview of the three methods used to estimate the VaR-format. Although to different degrees, all three methods rely on historical data.

management's credibility. Investors aware that a firm communicates its risk exposure more (less) transparently should be more (less) willing to invest *ceteris paribus*. This is because a less transparent risk disclosure may suggest that the firm is exposed to severe risks, which the management tries to conceal from investors. However, I posit that investors rely on a heuristic, that prevents them from *rationally* assessing the informativeness of the risk format. I argue that understanding the interplay between the estimation methods of the risk formats and uncertainty is a heavily demanding cognitive task. Individuals tend to avoid cognitively demanding tasks, opting for the less cognitively demanding option (Kool, McGuire, Rosen, and Botvinik 2010). They focus their judgments on the strengths of the evidence while neglecting its reliability (Griffin and Tversky 1992). Consistently, accounting research shows that investors tend to over-rely on unreliable information (Asay and Hales 2018; Bloomfield, Libby, and Nelson 2000; 2003; Nelson, Bloomfield, Hales, and Libby 2001). The SA-format reports the expected loss hypothesizing a 10% market factor change *without* any associated probability. Since individuals tend to avoid cognitively demanding tasks, it is reasonable to expect that investors will not try to estimate the probability of the SA-format market factor change. This implies that they fail to integrate the SA-format information into their investment assessments. Conversely, investors can directly integrate the VaR-format's worst-case loss, as it is explicitly associated with a very high probability. Chater and Lowenstein (2016) argue that the brain prefers simplified and easy to elaborate information because of its processing limitations. They suggest that the brain automatically favors the briefest explanation of the data. Additionally, individuals suppress ambiguity and uncertainty when intuitive judgments occur (Kahneman 2003). I posit that investors prefer the VaR-format because it is easier to integrate its information into their investment assessments. Therefore, they erroneously believe they can *always* rely on the VaR-format when assessing an investment. This should lead investors to perceive the VaR-format as more sophisticated than the SA-format.

Attribute substitution theory posits that when individuals assess a target attribute, they may use another readily available attribute instead as a substitute to assess the target attribute (Kahneman and Frederick 2002). Specifically, the target attribute must be difficult to assess for the substitution to occur. Individuals automatically assess other dimensions and use more specific and accessible pieces of information as a substitute for complex ones (Morewedge and Kahneman 2010). The informativeness of the risk format is arguably a complex attribute to assess. This is because it jointly depends on the estimation method of the risk format and the uncertainty. In contrast, the perceived sophistication of the risk format is an easy and intuitive attribute to assess. I expect investors to substitute the risk format's informativeness with its perceived sophistication. Therefore, investors who perceive the VaR-format as more sophisticated will also perceive it as more informative relative to the SA-format, which will affect how they assess their willingness to invest. When uncertainty is high, I predict that investors assess a higher willingness to invest for the firm reporting the less informative VaR-format compared to the more informative SA-format. Conversely, investors assess the risk as negligible when uncertainty is low. In this case, the risk format does not affect investors' willingness to invest because they consider the risk materialization to be very unlikely. Therefore, I posit that when uncertainty is low, investors' willingness to invest does not differ whether the firm reports the VaR-format or the SA-format.

H1: When uncertainty is high (low), investors' willingness to invest is higher (does not differ) for firms reporting the VaR-format compared to the SA-format.

This hypothesis is not without tension. I predict that investors rely on a heuristic to assess their investment willingness. However, I cannot a priori rule out that investors can rationally process the risk formats and understand that their informativeness does depend on uncertainty.

Management's credibility

Managers are free to choose between different risk formats and to change the risk formats between years. This disclosure flexibility may influence how investors perceive the management's credibility. Investors could use the risk format choice as a cue to assess whether managers disclosed the firm's risk exposure transparently or withheld information.

Prior literature identifies managers' situational incentives as a determinant of disclosure's credibility (Mercer 2004). That is, a disclosure consistent (inconsistent) with the management's incentives should be perceived as less (more) credible. Similarly, investors consider the management classifying a hybrid security as more credible when the classification is incentive-inconsistent vis-à-vis incentive-consistent (Hodge et al. 2006). In other words, investors believe that managers are more credible when their reporting decisions make them more vulnerable. When uncertainty is high, it is likely that strong fluctuations in the market factor will negatively affect the firm. Given that investors always (i.e., independent of uncertainty) perceive the VaR-format as more informative, I hypothesize that they consider the managers reporting the VaR-format as more credible. This is so, because they believe that the management makes an incentive-inconsistent choice by reporting the VaR-format. Despite the high uncertainty, managers report the risk format that discloses the firm's risk exposure more transparently, making them more vulnerable. On the other hand, investors assess the management reporting the SA-format as less credible. Investors perceive the SA-format to be less informative relative to the VaR-format, allowing the management to conceal the firm's risk exposure. Finally, when uncertainty is low, managers cannot choose a risk format that makes them vulnerable because investors consider the risk as negligible. Consequently, the risk format choice should not affect how investors perceive the management's credibility.

How investors perceive the management's credibility also affects the extent to which investors think they can rely on the disclosure. Namely, investors are more willing to rely on a

disclosure provided by a more credible management (Mercer 2005; Williams 1996). Similarly, investors rely to a greater extent on the management's forecast and are more confident about their earnings predictions when the management is more credible (Hirst, Koonce, and Miller 1999). Therefore, investors assessing a higher management's credibility will also be more willing to rely on the reported risk format. I expect that this will make investors feel better informed about the firm's risk exposure, which should, in turn, increase their willingness to invest. Taken together, I predict a moderated mediation where the effect of the risk format on the management's credibility is moderated by uncertainty, with management's credibility increasing investors' willingness to invest.

H2: When uncertainty is high (low), investors' assessment of management's credibility is higher (does not differ) for firms reporting the VaR-format compared to the SA-format. In turn, management's credibility positively affects investors' willingness to invest.

In a similar vein to H1, H2 is not without tension. If investors understand that the informativeness of the risk formats depends on uncertainty, they should assess the management as less (more) credible when the firm reports the less (more) informative risk format.

III. METHOD

Participants

I recruited 242 Amazon Mechanical Turk workers through the platform CloudResearch. To ensure a higher data quality, I excluded 15 observations of participants who failed the comprehension check and 7 observations of participants who completed the experiment in an unreasonable amount of time.[9] The final sample comprises 220 unique observations. On average, participants are 47% (53%) female (male) and 45 years old. At the

---

[9] In the full sample of 242 observations the average (median) duration of the experiment was 16.87 (12.93) minutes. Therefore, I excluded participants who spent less than 5 minutes or more than 45 minutes in the experiment. The main inferences of my results remain unchanged if I run my analysis on the full sample of 242 participants.

time of the experiment, participants had taken 5.28 accounting and finance university courses and had 23.21 years of work experience. Furthermore, 91% invested in common stock or would do so in the future.

Experimental design

I design a 2x2 between-subject experiment in which participants assume the role of potential investors.[10] They view information about the firm, its profitability, and the market risk disclosure reporting the interest rate risk. I manipulate the direction of the risk format change (change from VaR- to SA-format vs. change from SA- to VaR-format) and the degree of uncertainty (low uncertainty vs. high uncertainty). Participants in the change from VaR- to SA-format (change from SA- to VaR-format) conditions are informed that last year's disclosure reported the VaR-format (SA-format), whereas the current year's disclosure reports the SA-format (VaR-format).[11] I operationalize uncertainty by providing participants with an excerpt from the authoritative financial press. In the low (high) uncertainty conditions, the excerpt informs investors that the forecasted economic situation is stable (unstable) and that no fluctuations (strong fluctuations) are anticipated so that the economic situation will not (will) differ significantly from past years (see the Appendix B for an overview of the experimental material).

Participants are randomly assigned to one of the four experimental conditions. I run the experiment on the online survey platform Qualtrics. Participants receive a fixed compensation of $3 for completing the experiment. They spent an average (median) of 14.93 (12.75) minutes to complete the experiment, resulting in an average (median) hourly rate of

---

[10] IRB-approval was granted for the experiment by the ethics committee at the author's institution.

[11] When changing the risk format, firms must provide the reasons for the change and comparable information (SEC 1997b). Accordingly, I provide investors with the reasons for the risk format change and the prior year's risk information using the newly adopted risk format for the current year. For example, in the change from SA- to VaR-format conditions, the VaR-format reports the risk information for *both* the prior year and the current year.

$12.06 ($14.12). For a meaningful test of my hypothesis, participants must understand the features of the VaR-format and the SA-format. They read informational material about the risk formats, including their limitations and are informed that firms can freely choose the risk format.[12] Next, participants must correctly answer five multiple-choice questions to access the experiment. This screening ensures that participants are attentive and provides them with adequate knowledge of the settings. Once admitted, participants are informed about the fixed compensation for participating in the experiment, consent to the analysis and anonymous publication of data, and are instructed to assume the role of a potential investor. Afterwards, they view background information about the firm and its simplified income statement for the past two years. Participants also view the market risk disclosure of the interest rate risk, either in the VaR-format or the SA-format. Additionally, participants view an excerpt from the authoritative financial press, which informs them about the uncertainty. Next, participants assess a potential investment in the firm, the credibility of its management, and the risk formats using 101-point Likert scales. In the last part of the experiment, they are asked to answer manipulation checks, a comprehension test, and demographic questions.

IV.   RESULTS

Manipulation checks

To ensure that participants attended the experimental manipulations, I ask them to indicate the information provided by the risk format. I choose a conservative approach in formulating my manipulation check questions. I do not explicitly ask whether they viewed the VaR-format or the SA-format. Instead, I describe the information provided by the two risk formats and ask participants to select which one was reported. Similarly, for the manipulation

---

[12] Illustrating the limitations of each risk format works against finding support for my hypotheses, as it should make it easier for investors to understand that the informativeness of the risk format depends on uncertainty. Specifically, I inform participants that the SA-format does not provide a probability associated with the pre-specified market factor change, and that the VaR-format assumes that past market conditions will replicate in the future.

check about uncertainty, I ask them to indicate whether the financial press indicated a predictable (unpredictable) economic outlook. This approach should prevent inattentive participants from correctly answering the manipulation checks. Most participants correctly identified the information provided by the risk format (87%) and whether uncertainty was high or low (83%). Thus, I conclude that the experimental manipulations were successful.

Results

My theory suggests that investors perceive the VaR-format as more sophisticated and more informative than the SA-format. I ask investors to rate the degree of preparation difficulty for each risk format. I use their answers as a proxy for the perceived sophistication of the risk formats.[13] Investors assess a higher sophistication for the VaR-format than the SA-format (49.48 vs. 45.11, $t_{218} = -1.52$, $p = 0.07$, one-tailed, untabulated).[14] In line with my prediction, investors also assess the VaR-format as more informative than the SA-format (69.67 vs. 61.48, $t_{218} = -2.98$, $p < 0.01$, untabulated). Furthermore, I measure the importance investors assign to the alternative *not reported* risk format, that is, the risk format that *was not reported* in the market risk disclosure participants viewed. Investors provided with the VaR-format assess the importance of the SA-format and vice versa. This measure captures whether investors prefer a specific risk format. When provided with the SA-format, investors assessed the alternative *not reported* VaR-format to be more important than what investors provided with the VaR-format assessed the alternative *not reported* SA-format (67.01 vs. 61.50, $t_{218} = 1.97$, $p = 0.05$, untabulated).

These results indicate that investors consider the VaR-format as more sophisticated

---

[13] Individuals associate a certain degree of desirability to attain very difficult or unattainable goals (Yang, Stamatogiannakis, Chattopadhyay, and Chakravarti 2021). A risk format that is more difficult to prepare requires a higher level of competence and should be perceived as more sophisticated by investors.

[14] All p-values are two-tailed unless stated otherwise. One-tailed p-values are used for testing directional predictions.

and more informative independent of uncertainty.[15] H1 predicts that investors erroneously assess a higher willingness to invest for the firm reporting the less informative VaR-format when uncertainty is high. I measure on a 101-point Likert scale investors' willingness to invest by creating a composite measure of investment willingness and investment attractiveness (Table 1).[16] The Cronbach's α for these items is 0.93, indicating good reliability (Nunnally and Bernstein 1994).

I run an ANOVA to test whether the risk format, uncertainty, and their interaction affect investors' willingness to invest (Figure 1, Table 2, Panel A). The ANOVA shows a significant main effect of uncertainty ($F_{1,216} = 12.22$, $p < 0.001$) and a significant interaction effect ($F_{1,216} = 5.77$, $p = 0.02$). The simple effects analysis provides further insights into the interaction (Table 2, Panel B). The risk format does not affect investors' willingness to invest when uncertainty is low, indicating that investors in this case do not differentiate between risk formats (54.26 vs. 51.13, $F_{1,216} = 0.59$, $p = 0.44$). Conversely, when uncertainty is high, investors assess a higher willingness to invest for the firm reporting the less informative VaR-format compared to the more informative SA-format (48.00 vs. 37.39, $F_{1,216} = 7.01$, $p < 0.01$). Moreover, the uncertainty does not affect investors when the firm reports the VaR-format, as they assess an equivalent investment willingness in both uncertainty conditions (51.13 vs. 48.00, $F_{1,216} = 0.61$, $p = 0.44$). However, the uncertainty effect is significant when the firm reports the SA-format, with investors assessing a lower willingness to invest when uncertainty is high relative to low (37.39 vs. 54.26, $F_{1,216} = 17.20$, $p < 0.001$).

These results support H1. They show that when uncertainty is high, investors erroneously assess a higher willingness to invest for the firm reporting the less informative

---

[15] ANOVAs with risk format, uncertainty and their interaction as independent variables present all non-significant interaction terms for all the dependent variables mentioned (risk format sophistication, risk format informativeness, and alternative risk format importance, all $p > 0.32$, untabulated).

[16] Following prior literature, investment willingness and investment attractiveness capture investors' valuation of the firm's stock and the stocks' attractiveness as an investment (Koonce and Lipe 2010; 2017). I use the term "investment willingness" to refer to the composite measure for ease of exposition.

TABLE 1: Descriptive Statistics of Investment Willingness

	Investment Willingness Mean, (SD), n		
Change from VaR- to SA-format/Low Uncertainty	54.26	(19.16)	51
Change from VaR- to SA-format/High Uncertainty	37.39	(20.45)	58
Change from SA- to VaR-format/Low Uncertainty	51.13	(21.53)	57
Change from SA- to VaR-format/High Uncertainty	48.00	(23.36)	54

_____

Change from VaR- to SA-format and Change from SA- to VaR-format refer to the Risk format. Low Uncertainty and High Uncertainty refer to Uncertainty. Investment Willingness is the composite measure obtained by averaging participants' assessment on a 101-point Likert scale of investment willingness and investment attractiveness (Cronbach's $\alpha = 0.93$).

VaR-format. In a context of high uncertainty, investors are paradoxically less willing to invest in the firm reporting the more informative SA-format. Interestingly, it appears that investors are so driven by the risk format choice that when receiving what they perceive to be the more sophisticated risk format (i.e., VaR-format), uncertainty does not play a role in their assessment of investment willingness. That is, although not explicitly hypothesized, disclosing the VaR-format seems to neutralize any effect of uncertainty on investors' judgments. Consistent with my theory, the differences in the risk formats' estimation methods are too complex for investors to be fully understood. This ultimately misleads investors when assessing an investment.

Management's credibility

Next, I examine whether management's credibility mediates the effect of risk format and uncertainty on investors' willingness to invest. Consistent with prior literature (Mercer 2005), management's credibility is a composite measure of management's competence and management's trustworthiness ($\alpha = 0.79$).

H2 predicts that the VaR-format increases investors' perception of management's credibility compared to the SA-format, but *only* when uncertainty is high.

FIGURE 1: Interaction Graph - Results
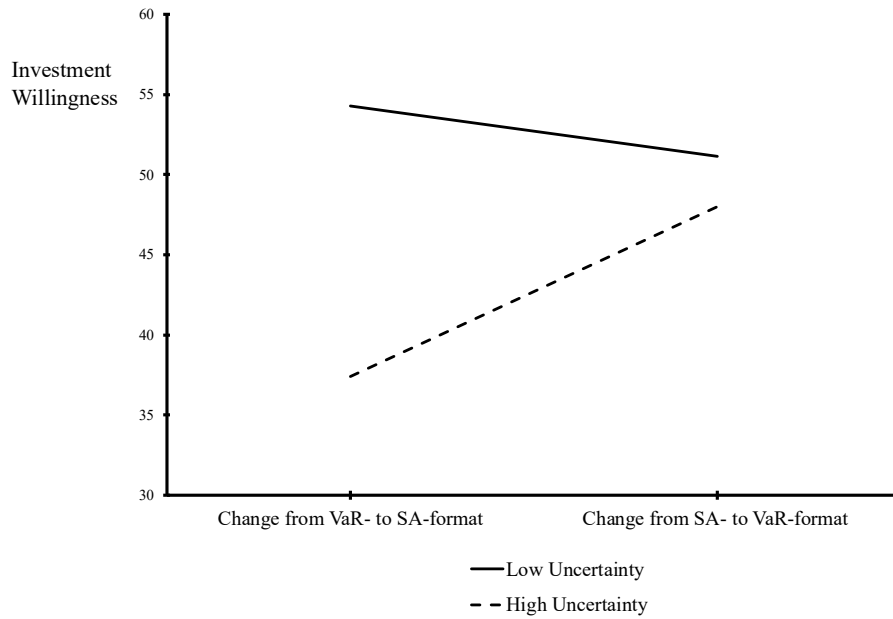
Figure 1 depicts the results of the ordinal interaction between the Risk format (Change from VaR- to SA-format vs. Change from SA- to VaR-format) and Uncertainty (Low Uncertainty vs. High Uncertainty) on Investment Willingness. Investment Willingness is measured as an average of investment willingness and investment attractiveness (Cronbach's $\alpha = 0.93$).

Higher management's credibility should, in turn, increase their willingness to invest. To test this hypothesis, I run Hayes' (2022) bootstrap-based moderated mediation model 7 (Table 3, Panel A).[17] The individual effects provide initial support for my hypothesis (Table 3, Panel B). The model shows a significant interaction of risk format and uncertainty on management's credibility (coeff = 8.06, SE = 4.40, 90% CI = [0.80, 15.32]) and that higher management's credibility leads to higher willingness to invest (coeff = 0.38, SE = 0.09, 90% CI = [0.24, 0.52]). Specifically, I find that when uncertainty is high, management's credibility mediates the effect of the risk format on investment willingness (coeff = 3.18, SE = 1.57, 90% CI = [0.93, 6.05], Table 3, Panel D).

---

[17] I estimate this moderated mediation model using the PROCESS macro (Hayes 2022) in the statistical software SPSS.

TABLE 2: ANOVA and Simple Effects on Investment Willingness

Panel A: Conventional ANOVA

Source	df	MS	F-statistic	p-value
Risk format (Change from VaR- to SA-format vs. Change from SA- to VaR-format)	1	767.16	1.71	0.19
Uncertainty (Low Uncertainty vs. High Uncertainty)	1	5490.68	12.22	< 0.001
Risk format x Uncertainty	1	2591.23	5.77	0.02
Error	216	449.44		

Panel B: Simple Effects

Comparison	df	F-statistic	p-value
Change from VaR- to SA-format vs. Change from SA- to VaR-format (given Low Uncertainty)	1	0.59	0.44
Change from VaR- to SA-format vs. Change from SA- to VaR-format (given High Uncertainty)	1	7.01	< 0.01
Low Uncertainty vs. High Uncertainty (given Change from VaR- to SA-format)	1	17.20	< 0.001
Low Uncertainty vs. High Uncertainty (given Change from SA- to VaR-format)	1	0.61	0.44

———————————————

Change from VaR- to SA-format and Change from SA- to VaR-format refer to the Risk format. Risk format is a dummy variable coded "0" for the Change from VaR- to SA-format and "1" for the Change from SA- to VaR-format. Low Uncertainty and High Uncertainty refer to Uncertainty. Uncertainty is a dummy variable coded "0" for Low Uncertainty and "1" for High Uncertainty. Investment Willingness is computed as the average of participants' assessment on a 101-point Likert scale of investment willingness and investment attractiveness (Cronbach's α = 0.93). All p-values are two-tailed.

However, I do not find support for this mediation when uncertainty is low (coeff = 0.12, SE = 1.09, 90% CI = [-1.72, 1.90], Table 3, Panel D). The index of moderated mediation indicates that the difference between the indirect effects at different levels of uncertainty is significant at a 90% level of confidence, implying an interaction (Index = 3.06; SE = 1.93; 90% CI = [0.28, 6.57], Table 3, Panel E). These findings are consistent with H2.

The direct effect of the risk format on investment willingness *before* the moderated mediation is not significant (coeff = 4.32, SE = 2.96, 90% CI = [-0.57, 9.21], Table 3, Panel B). However, a significant direct effect to be mediated is not necessary (Zhao, Lynch, and Chen 2010), as the strength of a mediation is demonstrated by the significance of the indirect effect (Jollineau and Bowen 2023; Preacher and Hayes 2004; 2008; Zhao et al. 2010). This is because an insignificant direct effect may be due to an indirect and a direct effect with different signs offsetting each other or two indirect effects canceling each other out (Jollineau and Bowen 2023).

V.   CONCLUSIONS

I investigate whether the risk formats of the market risk disclosure may have unintended effects on nonprofessional investors. My findings suggest that investors do not rationally process the risk formats. Specifically, they fail to understand that due to the differences between the estimation methods the risk formats' informativeness depends on uncertainty. Instead, investors appear to rely on the attribute substitution heuristic, using the perceived sophistication of the risk format to infer its informativeness. In particular, they perceive the VaR-format as more sophisticated and more informative than the SA-format. Investors are more willing to invest in the firm reporting the VaR-format when uncertainty is high, despite being less informative than the SA-format. In contrast, when uncertainty is low, investors do not differentiate between the risk formats so that their willingness to invest does not differ between firms reporting either the VaR-format or the SA-format. Consequently, investors' reliance on the risk formats' perceived sophistication ultimately misleads them. My results also indicate that the VaR-format may neutralize the effect of uncertainty on investors' willingness to invest. In contrast to the SA-format, the VaR-format seems to be able to fully reassure investors of any concerns that may arise in a context of high uncertainty.

TABLE 3: Moderated Mediation Analysis

Panel A: Moderated Mediation Analysis – Model Results

Risk format X Uncertainty

Interaction: Coeff.: 8.06*

Link 2: Coeff.: -7.77**

Uncertainty

Management's Credibility

Link 3: Coeff.: 0.38***

Link 1 Coeff.: 0.33

Risk format

Investment Willingness

Link A Coeff.: 4.32

Link A' Coeff.: 2.58
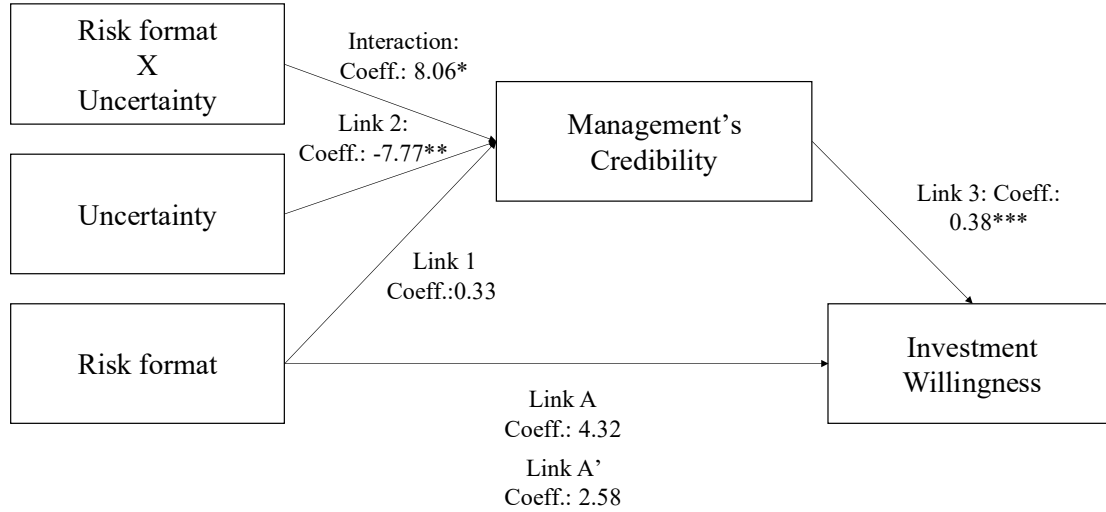
Panel B: Individual Effects

	Effect	SE	Lower 90% CI	Upper 90% CI
Link A (before moderated mediation): Risk format → Investment Willingness	4.32	2.96	-0.57	9.21
Link A' (after moderated mediation): Risk format → Investment Willingness	2.58	2.87	-2.17	7.32
Link 1: Risk format → Management's Credibility	0.33	3.14	-4.85	5.51
Link 2: Uncertainty → Management's Credibility	-7.77	3.12	-12.94	-2.61
Interaction: Risk format X Uncertainty → Management's Credibility	8.06	4.40	0.80	15.32
Link 3: Management's Credibility → Investment Willingness	0.38	0.09	0.24	0.52

Panel C: Conditional Effect of Risk Format

	Effect	SE	Lower 90% CI	Upper 90% CI
Effect of Risk format on Management's Credibility when Uncertainty is *Low*	0.33	3.14	-4.85	5.51
Effect of Risk format on Management's Credibility when Uncertainty is *High*	8.39	3.08	3.31	13.48

Panel D: Moderated Indirect Effect

	Effect	SE	Lower 90% CI	Upper 90% CI
Risk format → Management's Credibility → Investment Willingness when Uncertainty is *Low*	0.12	1.09	-1.72	1.90
Risk format → Management's Credibility → Investment Willingness when Uncertainty is *High*	3.18	1.57	0.93	6.05

Panel E: Index of Moderated Mediation

	Index	SE	Lower 90% CI	Upper 90% CI
Difference between indirect effects	3.06	1.93	0.28	6.57

_____

Panel A graphically presents the moderated mediation model based on Hayes' (2022) Model 7 estimated using the PROCESS macro in SPSS. Risk format is a dummy variable coded "0" for the Change from VaR- to SA-format and "1" for the Change from SA- to VaR-format. Uncertainty is a dummy variable coded "0" for Low Uncertainty and "1" for High Uncertainty. Investment Willingness is computed as the average of participants' assessment on a 101-point Likert scale of investment willingness and investment attractiveness (Cronbach's α = 0.93). Management's Credibility is computed as the average of management's competence and management's trustworthiness (Mercer 2005, Cronbach's α = 0.79) as reported by participants on a 101-point Likert scale. Link A reports the coefficient of the Risk Format on Investment Willingness *before* the moderated mediation. Link A' presents the estimates for Link A after the moderated mediation. Panel B reports the individual effects of the model. Panel C reports the effect of the Risk format on Management's Credibility at different levels of Uncertainty. Panel D reports the indirect effect of Risk format on Investment Willingness via Management's Credibility at different levels of Uncertainty. Panel E reports the index of moderated mediation testing if the difference between the indirect effects is statistically significant (Hayes 2022). The bootstrapping 90% confidence interval follows from 5'000 iterations.

*, ** and *** denote two-tailed significance levels of 10%, 5%, and 1%, respectively.

Since managers can freely choose the risk format to report, I further investigate whether investors' perception of the management's credibility plays a role in their investment assessments. My findings reveal that management's credibility mediates the effect of the risk format and uncertainty on investors' willingness to invest. When uncertainty is high, investors paradoxically assess the management reporting the less informative VaR-format as more credible, which in turn increases their willingness to invest.

My study complements the accounting literature focusing on investors' reliance on the attribute substitution heuristic to form investment judgments (e.g., Anderson, Hobson, and Sommerfeldt 2022; Kadous, Koonce, and Thayer 2012). I also contribute to the literature on uncertainty, which is still in its infancy (Bloom 2014). My findings inform standard setters about the unintended effects of disclosure flexibility in the market risk disclosure. The SEC (2016) opened the debate on whether such a degree of flexibility should be maintained. Standard setters could use this evidence to decide whether changing the regulation or other solutions (e.g., educating investors) could mitigate these unintended effects on investors. My findings have interesting implications for preparers as well. Schrand and Elliott (1998) warn that managers could use the great deal of flexibility to manipulate the market risk disclosure. Similarly, my study suggests that managers face a complex dilemma when uncertainty is high. They can choose to report the less informative VaR-format to increase investors' perception of their credibility. Alternatively, they may report the more informative SA-format at the cost of being perceived as less credible. This dilemma is important for managers, as investors' perception of the management's credibility influences their willingness to invest. Thus, standard setters may consider revisiting the disclosure requirements given that they appear to incentivize the management to report the less informative risk format. Finally, investors could benefit from these findings by gaining awareness of their own biases and hopefully mitigate them. In summary, my study suggests that the SEC's decision to allow firms to disclose their market risks with different risk formats may backfire.

My study is not without limitations, which offers opportunities for future research. Namely, it may be argued that investors do not substitute the risk format's informativeness with its perceived sophistication but rather with its ease of processing. While acknowledging that these are different constructs, I argue in the theory that individuals perceive the high probability worst-case loss of the VaR-format as more sophisticated because they believe they

can directly integrate it in their investment assessments. Conversely, the SA-format does not provide a probability, which implies that investors would have to estimate it autonomously to integrate the SA-format's information in their investment assessments. I expect investors to consider a risk format that requires further processing as less sophisticated. That is, the perceived sophistication is strictly intertwined with the ease of processing. Nevertheless, future studies could try to disentangle these constructs more precisely. Another limitation consists in the experiment featuring a simplified financial disclosure, which abstracts from the complexities of real-world financial reporting. Moreover, participants are presented with a dynamic disclosure choice. They are informed that the management changed the risk format for the current year's disclosure. Future research may investigate how providing a market risk disclosure without a risk format change will affect investors. Finally, future studies could also examine how exposing investors to multi-period market risk disclosures would affect them.

REFERENCES

Amiram, D., W.R. Landsman, E.L. Owens, and S.R. Stubben. 2018. How are analysts' forecast affected by high uncertainty? *Journal of Business Finance and Accounting* 45 (3-4): 295-318.

Anderson, S.B., J.L. Hobson, and R.D. Sommerfeldt. 2022. Auditing Non-GAAP Measures: Signaling More Than Intended. *Contemporary Accounting Research* 39 (1): 577-606.

Apple, Inc. 2023. *Form 10-K.* Available at: https://d18rn0p25nwr6d.cloudfront.net/CIK-0000320193/faab4555-c69b-438a-aaf7-e09305f87ca3.pdf (last accessed October 10, 2024).

Asay, H.S., and J. Hales. 2018. Disclaiming the Future: Investigating the Impact of Cautionary Disclaimers on Investor Judgments Before and After Experiencing Economic Loss. *The Accounting Review* 93 (4): 81-99.

Bloom, N. 2014. Fluctuations in Uncertainty. *Journal of Economic Perspectives 2*8 (2): 153-176.

Bloom, N., H. Ahir, and D. Furceri. 2022. *Visualizing the Rise of Global Economic Uncertainty*. Available at: https://hbr.org/2022/09/visualizing-the-rise-of-global-economic-uncertainty (last accessed: November 13, 2023).

Bloomfield, R., R. Libby, and M.W. Nelson. 2000. Underreactions, overreactions and moderated confidence. *Journal of Financial Markets* 3 (2): 113-137.

Bloomfield, R.J., R. Libby, and M.W. Nelson. 2003. Do Investors Overrely on Old Elements of the Earnings Time Series? *Contemporary Accounting Research* 20 (1): 1-31.

Bochkay, K., and P.R. Joos. 2021. Macroeconomic Uncertainty and Quantitative versus Qualitative Inputs to Analyst Risk Forecasts. *The Accounting Review* 96 (3): 59-90.

Cannon, N.H. 2015. Fair Value Measurement under High Uncertainty: The Effects of Disclosure Format and Management Aggressiveness on Users' Risks Assessments. Available at: *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2731367* (last accessed October 2, 2024).

Chater, N., and G. Loewenstein. 2016. The under-appreciated drive for sense-making. *Journal of Economic Behavior & Organization* 126 (Part B): 137-154.

Clor-Proell, S.M. 2009. The Effects of Expected and Actual Accounting Choices on Judgments and Decisions. *The Accounting Review* 84 (5): 1465-1493.

Dyer, T., M. Lang, and L. Stice-Lawrence. 2017. The evolution of 10-K textual disclosure: Evidence from Latent Dirichlet Allocation. *Journal of Accounting and Economics* 64 (2-3): 221-245.

Eilifsen, A., E.L. Hamilton, and W.F. Messier, Jr. 2021. The importance of quantifying uncertainty: Examining the effects of quantitative sensitivity analysis and audit materiality disclosures on investors' judgments and decisions. *Accounting, Organizations and Society* 90: Article 101169.

Elmy, F.J., L.P. LeGuyader, and T.J. Linsmeier. 1998. A Review of Initial Filings under the SEC's New Market Risk Disclosure Rules. *The Journal of Corporate Accounting and Finance* 9 (4): 33-45.

Fanning, K., C.P. Agoglia, and M.D. Piercey. 2015. Unintended Consequences of Lowering Disclosure Thresholds. *The Accounting Review* 90 (1): 301-320.

FedEx Corporation. 2024. *Form 10-K*. Available at: https://d18rn0p25nwr6d.cloudfront.net/CIK-0001048911/8b5589de-a765-4fc7-b41b-162ef233ee5e.pdf (last accessed October 10, 2024).

General Mills, Inc. 2024. *Form 10-K*. Available at https://d18rn0p25nwr6d.cloudfront.net/CIK-0000040704/068407f4-473b-4a0a-b1d3-0f363aef7c82.pdf (last accessed October 10, 2024).

Griffin, D. and A. Tversky. 1992. The Weighing of Evidence and the Determinants of Confidence. *Cognitive Psychology* 24 (3): 411-435.

Hayes, A.F. 2022. *Introduction to Mediation, Moderation, and Conditional Process Analysis. A Regression-Based Approach.* Third Edition. New York, NY, USA: The Guilford Press.

Hirst, D.E., L. Koonce, and J. Miller. 1999. The Joint Effect of Management's Prior Forecast Accuracy and the Form of Its Financial Forecasts on Investor Judgment. *Journal of Accounting Research* 37: 101-124.

Hodder, L., L. Koonce, and M.L. McAnally. 2001. SEC Market Risk Disclosure: Implications for Judgment and Decision Making. *Accounting Horizons* 15 (1): 49-70.

Hodder, L., and M.L. McAnally. 2001. SEC Market-Risk Disclosures: Enhancing Comparability. *Financial Analysts Journal* 57 (2): 62-78.

Hodge, F., P.E. Hopkins, and J. Pratt. 2006. Management reporting incentives and classification credibility: The effects of reporting discretion and reputation. *Accounting, Organizations and Society* 31 (7): 623-634.

International Accounting Standards Board (IASB). 2024. *IFRS 7 Financial Instruments*. London, U.K.: IASB.

Jollineau, J.S., and R.M. Bowen. 2023. A Practical Guide to Using Path Analysis: Mediation and Moderation in Accounting Research. *Journal of Financial Reporting* 8 (1): 11–40.

Jorion, P. 2002. How Informative Are Value-at-Risk Disclosure? *The Accounting Review* 77 (4): 911-931.

Kadous, K., L. Koonce, and J.M. Thayer. 2012. Do Financial Statements Users Judge Relevance Based on Properties of Reliability? *The Accounting Review* 87 (4): 1335-1356.

Kahneman, D., and S. Frederick. 2002. Representativeness revisited: Attribute substitution in intuitive judgment. In *Heuristics of Intuitive Judgment: Extensions and Applications*, edited by T. Gilovich, D. Griffin, and D. Kahneman. Cambridge, U.K.: Cambridge University Press.

Kahneman, D. 2003. Maps of Bounded Rationality: Psychology for Behavioral Economics. *The American Economic Review* 93 (5): 1449-1475.

Kelton, A.S., and N.R. Montague. 2018. The unintended consequences of uncertainty disclosures made by auditors and managers on nonprofessional investor judgments. *Accounting, Organizations and Society* 65: 44-55.

Kool, W., J.T. McGuire, Z.B. Rosen, and M.M. Botvinick. 2010. Decision Making and the Avoidance of Cognitive Demand. *Journal of Experimental Psychology: General* 139 (4): 665-682.

Koonce, L., M.G. Lipe, and M.L. McAnally. 2005. Judging the Risk of Financial Instruments: Problems and Potential Remedies. *The Accounting Review* 80 (3): 871-895.

Koonce, L., and M.G. Lipe. 2010. Earnings Trend and Performance Relative to Benchmarks: How Consistency Influences Their Joint Use. *Journal of Accounting Research* 48 (4): 859–884.

Koonce, L., and M.G. Lipe. 2017. Firms with Inconsistently Signed Earnings Surprises: Do Potential Investors Use a Counting Heuristic? *Contemporary Accounting Research* 34 (1): 292–313.

Linsmeier, T.J., and N.D. Pearson. 1997. Quantitative Disclosures of Market Risk in the SEC Release. *Accounting Horizons* 11 (1): 107-135.

Linsmeier, T.J., and N.D. Pearson. 2000. Value at Risk. *Financial Analysts Journal* 56 (2): 47-67.

Linsmeier, T.J., D.B. Thornton, M. Venkatachalam, and M. Welker. 2002. The Effect of Mandated Market Risk Disclosures on Trading Volume Sensitivity to Interest Rate, Exchange Rate, and Commodity Price Movements. *The Accounting Review* 77 (2): 343-377.

Lobo, G.J., W.Z. Siqueria, K. Tam, and J. Zhou. 2019. Does SEC FRR No. 48 disclosure communicate risk management effectiveness? *Journal of Accounting and Public Policy* 38 (6): 106696.

Loh, R.K., and R.M. Stulz. 2018. Is Sell-Side Research More Valuable in Bad Times? *The Journal of Finance* 73 (3): 959-1013.

Mercer, M. 2004. How Do Investors Assess the Credibility of Management Disclosures? *Accounting Horizons* 18 (3): 185-196.

Mercer, M. 2005. The Fleeting Effects of Disclosure Forthcomingness on Management's Reporting Credibility. *The Accounting Review* 80 (2): 723-744.

Morewedge, C.K., and D. Kahneman. 2010. Associative processes in intuitive judgment. *Trends in Cognitive Sciences* 14 (10): 435-440.

Nelson, M.W., R. Bloomfield, J.W. Hales, and R. Libby. 2001. The Effect of Information Strength and Weight on Behavior in Financial Markets. *Organizational Behavior and Human Decision Processes* (86) 2: 168-196.

Nelson, M.W., and K.K Rupar. 2015. Numerical Formats within Risk Disclosures and the Moderating Effect of Investors' Concerns about Management Discretion. *The Accounting Review* 90 (3): 1149-1168.

Nunnally, J.C., and I.H. Bernstein. 1994. *Psychometric Theory*. Third Edition. New York, NY, USA: McGraw-Hill.

Preacher, K.J., and A.F. Hayes. 2004. SPSS and SAS procedures for estimating indirect effects

in simple mediation models. *Behavior Research Methods, Instruments, & Computers* 36 (4): 717–731.

Preacher, K.J., and A.F. Hayes. 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods* 40 (3): 879–891.

Roulstone, D.T. 1999. Effect of SEC Financial Reporting Release No. 48 on Derivative and Market Risk Disclosures. *Accounting Horizons* 13 (4): 343-363.

Schrand, C.M., and J.A. Elliott. 1998. Risk and Financial Reporting: A Summary of the Discussion at the 1997 AAA/FASB Conference. *Accounting Horizons* 12 (3): 271-282.

Securities and Exchange Commission (SEC). 1997a. *Disclosure of Accounting Policies for Derivative Financial Instruments and Derivative Commodity Instruments and Disclosure of Quantitative and Qualitative Information about Market Risk Inherent in Derivative Financial Instruments, Other Financial Instruments, and Derivative Commodity Instruments.* Final Rules. Release Nos. 33-7386; 34-38223; IC-22487; FR-48; International Series No. 1047; File No. S7-35-95. Washington, D.C. Available at: https://www.sec.gov/files/rules/final/33-7386.txt (last accessed February 22, 2024).

Securities and Exchange Commission (SEC). 1997b. *Questions and Answers About the New "Market Risk" Disclosure Rules.* Available at: https://www.sec.gov/divisions/corpfin/guidance/derivfaq.htm (last accessed March 4, 2024).

Securities and Exchange Commission (SEC). 2016. *Business and Financial Disclosure Required by Regulation S-K.* Concept Release. (Release No. 33-10064; 34-77599; File No. S7-06-16). Washington, D.C. Available at: https://www.sec.gov/files/litigation/litreleases/2016/33-10064.pdf (last accessed: October 14, 2024).

Tesla, Inc. 2022. *Form 10-K.* Available at: https://www.sec.gov/Archives/edgar/data/1318605/000095017022000796/tsla-20211231.htm (last accessed October 10, 2024).

The Interpublic Group of Companies, Inc. 2024. *Form 10-K.* Available at: https://interpublicgroup.gcs-web.com/static-files/4b62a295-c210-44c3-8a4b-621fb115cabe (last accessed October 10, 2024).

Williams, P.A. 1996. The Relation Between a Prior Earnings Forecast by Management and Analyst Response to a Current Management Forecast. *The Accounting Review* 71 (1): 103-113.

Yang, H., A. Stamatogiannakis, A. Chattopadhyay, and D. Chakravarti. 2021. Why We Set Unattainable Goals. *Harvard Business Review.* Available at: https://hbr.org/2021/01/why-we-set-unattainable-goals (last accessed January 4, 2024).

Zhao, X., J.G. Lynch, Jr., and Q. Chen. 2010. Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research* 37 (2): 197–206.

APPENDIX A

Real-World Excerpts of Market Risk Disclosures

The Interpublic Group of Companies, Inc., Form 10-K, 2024

Interest Rates

Our exposure to market risk for changes in interest rates relates primarily to the fair market value and cash flows of our debt obligations. The majority of our debt (approximately 99% and 98% as of December 31, 2023 and 2022, respectively) bears interest at fixed rates. We do have debt with variable interest rates, but a 10% increase or decrease in interest rates would not be material to our interest expense or cash flows. The fair market value of our debt is sensitive to changes in interest rates, and the impact of a 10% change in interest rates is summarized below.

As of December 31,	Increase/(Decrease) in Fair Market Value	
	10% Increase in Interest Rates	10% Decrease in Interest Rates
2023	$ (115.3)	$ 111.0
2022	(99.2)	127.1

We had $2,388.3 of cash, cash equivalents and marketable securities as of December 31, 2023 that we generally invest in conservative, short-term bank deposits or securities. The interest income generated primarily from these investments is subject to both domestic and foreign interest rate movements. During 2023 and 2022, we had interest income of $140.8 and $56.6, respectively. Based on our 2023 results, a 100 basis-point increase or decrease in interest rates would affect our interest income by approximately $23.9, assuming that all cash, cash equivalents and marketable securities are impacted in the same manner and balances remain constant from year-end 2023 levels.

Tesla, Inc., Form 10-K, 2022

Interest Rate Risk

We are exposed to interest rate risk on our borrowings that bear interest at floating rates. Pursuant to our risk management policies, in certain cases, we utilize derivative instruments to manage some of this risk. We do not enter into derivative instruments for trading or speculative purposes. A hypothetical 10% change in interest rates on our floating rate debt would have increased or decreased our interest expense for the years ended December 31, 2021 and 2020 by $2 million and $4 million, respectively.

FedEx Corporation, Form 10-K, 2024

FOREIGN CURRENCY. While we are a global provider of transportation, e-commerce, and business services, the majority of our transactions during the periods presented in this Annual Report are denominated in U.S. dollars. The principal foreign currency exchange rate risks to which we are exposed are in the euro, Chinese yuan, British pound, Canadian dollar, Australian dollar, Mexican peso, Hong Kong dollar, and Japanese yen. Historically, our exposure to foreign currency fluctuations is more significant with respect to our revenue than our expenses, as a significant portion of our expenses are denominated in U.S. dollars, such as aircraft and fuel expenses. Foreign currency fluctuations had a slightly negative impact on operating income in 2024 and a slightly negative impact on operating income in 2023. However, favorable foreign currency fluctuations also may have had an offsetting impact on the price we obtained or the demand for our services, which is not quantifiable. At May 31, 2024, the result of a uniform 10% strengthening in the value of the dollar relative to the currencies in which our transactions are denominated would result in a decrease in expected operating income of approximately $400 million for 2025. This theoretical calculation assumes that each exchange rate would change in the same direction relative to the U.S. dollar, which is not consistent with our actual experience in foreign currency transactions. In addition to the direct effects of changes in exchange rates, fluctuations in exchange rates also affect the volume of sales or the foreign currency sales price as competitors' services become more or less attractive. The sensitivity analysis of the effects of changes in foreign currency exchange rates does not factor in a potential change in sales levels or local currency prices.

Apple, Inc., Form 10-K, 2023

Foreign Exchange Rate Risk

The Company's exposure to foreign exchange rate risk relates primarily to the Company being a net receiver of currencies other than the U.S. dollar. Changes in exchange rates, and in particular a strengthening of the U.S. dollar, will negatively affect the Company's net sales and gross margins as expressed in U.S. dollars. Fluctuations in exchange rates may also affect the fair values of certain of the Company's assets and liabilities. To protect against foreign exchange rate risk, the Company may use derivative instruments, offset exposures, or adjust local currency pricing of its products and services. However, the Company may choose to not hedge certain foreign currency exposures for a variety of reasons, including accounting considerations or prohibitive cost.

The Company applied a value-at-risk ("VAR") model to its foreign currency derivative positions to assess the potential impact of fluctuations in exchange rates. The VAR model used a Monte Carlo simulation. The VAR is the maximum expected loss in fair value, for a given confidence interval, to the Company's foreign currency derivative positions due to adverse movements in rates. Based on the results of the model, the Company estimates, with 95% confidence, a maximum one-day loss in fair value of $669 million and $1.0 billion as of September 30, 2023 and September 24, 2022, respectively. Changes in the Company's underlying foreign currency exposures, which were excluded from the assessment, generally offset changes in the fair values of the Company's foreign currency derivatives.

VALUE AT RISK

The estimates in the table below are intended to measure the maximum potential fair value we could lose in one day from adverse changes in market interest rates, foreign exchange rates, commodity prices, and equity prices under normal market conditions. A Monte Carlo value-at-risk (VAR) methodology was used to quantify the market risk for our exposures. The models assumed normal market conditions and used a 95 percent confidence level.

The VAR calculation used historical interest and foreign exchange rates, and commodity and equity prices from the past year to estimate the potential volatility and correlation of these rates in the future. The market data were drawn from the RiskMetrics™ data set. The calculations are not intended to represent actual losses in fair value that we expect to incur. Further, since the hedging instrument (the derivative) inversely correlates with the underlying exposure, we would expect that any loss or gain in the fair value of our derivatives would be generally offset by an increase or decrease in the fair value of the underlying exposure. The positions included in the calculations were: debt; investments; interest rate swaps; foreign exchange forwards; commodity swaps, futures, and options; and equity instruments. The calculations do not include the underlying foreign exchange and commodities or equity-related positions that are offset by these market-risk-sensitive instruments.

The table below presents the estimated maximum potential VAR arising from a one-day loss in fair value for our interest rate, foreign currency, commodity, and equity market-risk-sensitive instruments outstanding as of May 26, 2024.

In Millions		May 26, 2024		Average During Fiscal 2024		May 28, 2023	Analysis of Change
Interest rate instruments	$	53.5	$	56.0	$	65.3	Lower Market Volatility
Foreign currency instruments		29.8		30.1		36.7	Exchange Rate Volatility
Commodity instruments		4.5		5.1		7.6	Lower Market Volatility
Equity instruments		1.8		2.1		2.8	Lower Market Volatility

APPENDIX B

Risk format manipulation

[*Change from VaR- to SA-format*]

Risk disclosure

As mandated by current legislation, we provide forward-looking risk information about ANDROMEDA INC.'s exposure to the interest rate risk.

Last year, we reported this risk information in the Value-at-Risk (VaR) format. This year, we report this risk information in the sensitivity analysis format. Given the forecasted economic outlook for the next year, we believe that the sensitivity analysis format better depicts ANDROMEDA INC.'s risk exposure (see below for additional information about the forecasted economic outlook). For reasons of comparability, we additionally report the last year's risk exposure in the sensitivity analysis format.

Sensitivity analysis

To provide a meaningful assessment of the interest rate risk associated with ANDROMEDA INC.'s interest risk exposure, we performed a sensitivity analysis to determine the loss on future earnings that a change in interest rates would cause. A sensitivity analysis is estimated by assuming a certain market factor change. Nevertheless, no probability regarding this change is disclosed. Based on the loan positions as of December 31, 20x1, and December 31, 20x0, ANDROMEDA INC. estimates that a hypothetical 10% increase in interest rates across all maturities would result in a $88 million and $86 million one-year loss on the net income before taxes, respectively.

[*Change from SA- to VaR-format*]

Risk disclosure

As mandated by current legislation, we provide forward-looking risk information about ANDROMEDA INC.'s exposure to the interest rate risk.

Last year, we reported this risk information in the sensitivity analysis format. This year, we report this risk information in the Value-at-Risk (VaR) format. Given the forecasted economic outlook for the next year, we believe that the Value-at-Risk (VaR) format better depicts ANDROMEDA INC.'s risk exposure (see below for additional information about the forecasted economic outlook). For reasons of comparability, we additionally report the last year's risk exposure in the Value-at-Risk (VaR) format.

Value-at-Risk

To provide a meaningful assessment of the interest rate risk associated with ANDROMEDA INC.'s interest risk exposure, we performed a Value-at-Risk (VaR) model to determine the loss on future earnings that fluctuations in interest rates would cause. The VaR model consisted of a simulation to generate thousands of random market paths assuming normal market conditions. The VaR is the maximum expected loss on future earnings due to adverse fluctuations in interest rates. Nevertheless, past market conditions may not replicate in the future. Based on the loan positions as of December 31, 20x1, and December 31, 20x0, ANDROMEDA INC. estimates with 95% confidence (probability) a maximum $88 million and $86 million one-year loss on the net income before taxes, respectively.

Uncertainty manipulation

[*Low Uncertainty*]

> **Forecasted economic outlook**
> Furthermore, you are aware that the authoritative financial press depicts the following economic outlook for the next year:
> The forecasted overall economic situation is stable. Analysts do not expect any significant fluctuations in the economic situation for the next year. It is reasonable to expect that the economic situation will not deviate significantly from past years.

[High Uncertainty]

> **Forecasted economic outlook**
> Furthermore, you are aware that the authoritative financial press depicts the following economic outlook for the next year:
> The forecasted overall economic situation is instable. Analysts do expect significant fluctuations in the economic situation for the next year. It is reasonable to expect that the economic situation will deviate significantly from past years.

ESSAY 3

What's in a Number?

Voluntary Quantification of Risk Factor Disclosures and Investors' Perceptions of Risk, Management's Credibility, and Disclosure Usefulness

> "Risk cannot be quantified, even after the fact."
>
> Howard Marks

Alessandro Cortese
University of Bern

Alexis H. Kunz
University of Bern

ABSTRACT: Regulators, firms, and investors grapple with the question whether *qualitative* risk factor disclosures (RFDs) in 10-K filings should include *quantitative* risk estimates. We examine how the voluntary provision of quantitative risk estimates in qualitative RFDs affects investors' perceptions of (i) the preparer's risk, (ii) its management's credibility, and (iii) the perceived usefulness of the disclosure. Based on theory from psychology, we predict and find that the voluntary quantification of risk increases investors' perceptions of management's credibility and disclosure usefulness even though investors have no means to evaluate the preparer's competence in quantifying the risk. We further predict and find that the effect of risk quantification on investors' credibility perceptions interacts with peer disclosures because investors' perceptions tend to increase (decrease) for preparers who are more (less) accommodating in explaining the impact of the risk on firm metrics than their peers. Our study informs regulators and preparers on boundary conditions for the voluntary quantification of risk and on potentially detrimental effects of mandating quantitative risk estimates in RFDs.

KEYWORDS: *disclosure usefulness, management's credibility, risk factor disclosure, risk perceptions, risk quantification, trait assessments, social signaling, voluntary disclosure.*

I. INTRODUCTION

Understanding and accounting for the risk inherent in an investment is arguably one of the most difficult tasks that investors face. Notwithstanding this difficulty, literature and practice seem to be in rare agreement that investors' capacity to do so ultimately defines the fine line between sound investment decisions and reckless bets (Graham and Dodd 2023; Newall and Weiss-Cohen 2022). To help investors assess the risk of investments, the Securities and Exchange Commission (SEC) mandates registrants to report *qualitative* risk factor disclosures (RFDs) of their significant risk factors in 10-K filings (SEC 2005). However, registrants are not obliged to *quantify* the risks they disclose (SEC 2005; SEC 2016). Qualitative RFDs are notoriously difficult to assess for investors (Bao and Datta 2014; Histen 2022; Kravet and Muslu 2013). Aware of this problem, the SEC recently solicited comments on whether RFDs should include quantitative risk measures (SEC 2016). While prior research has shown that presentation formats can affect investors' risk perceptions (Glaser, Iliewa, and Weber 2019), the question what effect *quantitative* RFDs might have on investors remains an open question.

Prior research suggests that firms with higher credibility seem to be more successful in communicating information to markets (Mercer 2004; Wiliams 1996). We investigate how the *voluntary* provision of *quantitative* estimates in a qualitative RFD affects investors' perceptions of the (i) preparer's *risk,* (ii) its *management's credibility,* and (iii) the *perceived decision-usefulness of the disclosure*. Understanding investors' reactions to variations in risk disclosures is important. On the one hand, firms may voluntarily opt for quantification. On the other hand, the SEC may either mandate or encourage quantitative RFDs. If the SEC encourages quantitative RFDs without mandating them, this is likely to result in a reporting environment in which some firms adopt quantifications while others will not. In either case, the ensuing variation in risk disclosure types would force investors to compare between firms

that inform differently, which, in turn, is likely to affect their reaction to the information communicated by these firms.

Our research questions are not without tension. While investors may appreciate quantitative RFDs because they convey the impact of risk in a more transparent manner (Hope, Hu, and Lu 2016; SEC 2016), quantitative risk disclosures are likely to make a preparer's risk more salient, which, in turn, is likely to heighten investors' risk perceptions.[1] Additionally, prior research suggests that people may hold firm beliefs that 'risk cannot be quantified' (e.g., Marks 2022) or that the quantification of risk constitutes an inappropriate characterization of the available data that may indicate a deficient comprehension of the risk and the way it should be handled (Ballou, Heitger, and Stoel 2011; Power 2009; Stoel, Ballou, and Heitger 2017). Given that quantitative risk measures may be perceived as cues for overconfidence or even incompetence, investors may feel that quantitative RFDs are less credible and less relevant than qualitative RFDs. Consequently, the disclosure of quantitative RFDs may not only harm management's credibility but also impair the perceived decision-usefulness of the disclosure itself.

A quantitative RFDs reflects the management's perception of the preparers' risk and its reporting incentives (Beatty, Cheng, and Zhang 2019; Campbell, Chen, Dhaliwal, Lu, and Steele 2014; Moon 2020). Therefore, we hypothesize that the *voluntary* disclosure of a *quantitative* RFD conveys a dual signal to investors. First, it provides more *precise* information about the management's risk perception than qualitative disclosures (Beatty et al. 2019; Campbell et al. 2014; Moon 2020). Second, it also conveys information about the management's willingness to *explain* the specific consequences of the risk on firm metrics. Information about the management's risk perception is an economic signal that informs

---

[1] See e.g., Koonce, McAnally, and Mercer (2005) who provide experimental evidence that the disclosure of the amount of a potential loss outcome increases investors' risk perceptions.

investors on the potential downside of an investment in the firm. Information about the management's inclination to *explain* the consequences of the risk on firm metrics is a social signal (Poggi and D'Errico 2012; Wolff 2022). As such, it shows to investors that a firm makes the effort to *explain* the impact of the risk to them by translating somewhat arcane qualitative risk disclosures to very concrete accounting numbers. Therefore, investors are likely to interpret the voluntary disclosures of quantitative RFDs as a cue for the preparer's cooperative attitude towards them.

Drawing from attribution theory and research on associative impression formation, we theorize that economic and social signals trigger different psychological processes in investors that ultimately affect the credibility of the preparer's management and its disclosure differently. As an economic signal, a quantitative RFD is likely to increase investors' risk perceptions because quantification tends to render risk more salient. However, based on attribution theory, we hypothesize that a quantitative RFD may simultaneously be interpreted as a social signal because absent any obvious motives for quantifying the risk, investors tend to attribute the reasons for the quantification to presumed pro-social traits of the preparer's management. Based on research on associative impression formation, we expect that the favorable impressions that investors form about the management due to the presumed pro-social traits will increase their perceptions of the management's credibility and the disclosure usefulness *even* in the absence of any directly relevant evidence for such conclusions.

To provide a clean test of the incremental effect of risk quantification, we hold risk information and firm economics constant across conditions. That is, we chose a setting in which investors simultaneously receive RFDs of a focal firm and a perfectly comparable peer firm and at least one of the two firms reports a quantitative RFD. Due to this design, investors can, except for the baseline condition where both firms report qualitative RFDs, always infer the quantitative risk via the focal firm or the peer firm respectively. To provide a clean test of the

concerns voiced in the risk management literature, we do not provide participants with any information about the preparers' competence in quantifying the risk.

We test our hypotheses in a 2x2 between-subject design. We manipulate (1) the choice of the RFD-type of the focal firm (qualitative vs. quantitative RFD) and (2) RFD-contrast, i.e., whether the focal and the peer firms report the same RFD-types or whether they report different RFD-types (same vs. different RFD-types). We manipulate RFD-type of the focal firm (qualitative vs. quantitative RFD) to examine the incremental effect of the voluntary quantification of risk beyond the qualitative disclosure of risk. We manipulate RFD-contrast (same vs. different RFD-types) to examine investors' reaction to the fact that one firm voluntarily reports more (or less) helpful information in explaining the consequences of the risk than its peer. This allows us to test whether the positive effect of reporting a quantitative RFD on investors' credibility assessments of the focal firm's management will be stronger when the peer firm fails to do so.

We find empirical support for our predictions. We find that preparers can increase investors' perceptions of management's credibility and disclosure usefulness through the voluntary quantification of risk *despite* the fact that investors have no mean to assess the preparers' competence in so doing. Therefore, our study provides empirical evidence that investors tend to reward social signaling through the voluntary quantification of risk *without* accounting for the credibility of the risk signal. We also find that beneficial effects of quantitative RFDs interact with social signals of the preparer's peers. That is, the possibility (impossibility) to attribute a quantitative RFD of a peer to pro-social personality traits of its management, decreases (increases) investors' perceptions of the *focal* firm *independent* of the RFD-type reported by the focal firm. Therefore, our findings suggest that investors tend to reward (punish) preparers who are more helpful (less helpful) than their peers in explaining the consequences of the risk through higher (lower) credibility perceptions.

We believe our study provides interesting implications for preparers, regulators, and investors. First, we find no support for concerns voiced in the risk management literature that people are innately skeptical towards the quantification of risk factors such that they may discount or discard quantitative RFDs based on presumptions of managerial overconfidence or incompetence. On the contrary, our findings suggest that investors tend to perceive preparers who report quantified RFDs as *more* competent and *more* credible than preparers who report qualitative RFDs, *even* if they have no way of assessing the management's expertise in quantifying the risk in the first place. Second, since this is so, our study provides empirical evidence for potentially dysfunctional reactions of investors to the voluntary disclosure of quantitative RFDs. That is, our findings caution investors to account for preparers' competence in quantifying risk *before* assessing the credibility of the management or the usefulness of the disclosure. Third, because the impact of social signaling via quantitative RFDs appears to be inversely proportional to the number of firms disclosing quantitative RFDs, our research informs preparers and regulators on boundary conditions for the enhancement of investors' credibility and competence perceptions via the quantification of RFDs. By the same token, our findings also inform regulators and preparers on potentially negative repercussions of mandating quantified RFDs on preparers' efforts to improve their credibility with investors.

The remainder of this paper is organized as follows. Section II describes our setting, outlines the theoretical framework, and develops the hypotheses. Section III presents the experimental design. Section IV discusses the findings, and Section V concludes.

II. BACKGROUND, THEORY, AND HYPOTHESES

RFDs reflect the management's perception of the preparers' risk and the management's reporting incentives (Beatty et al. 2019; Campbell et al. 2014; Moon 2020). Therefore, when voluntarily reporting a *quantitative* RFD, an entity simultaneously reports information that is more precise about the management's risk perception *and* its willingness to explain the impact of the risk on firm metrics to investors. The disclosure of quantitative RFDs is likely to render the preparer's risk more salient than a qualitative RFD because investors can better gauge the impact of the risk on firm metrics. Individuals overweight salient signals while underweighting non-salient signals (Bordalo, Gennaioli, and Shleifer 2022; Taylor and Thompson 1982). Therefore, we predict that the voluntary disclosure of a quantitative RFD will increase investors' perceptions of the preparer's risk.

H1: The voluntary disclosure of a quantitative RFD increases investors' risk perceptions of the reporting entity *ceteris paribus*.

RFDs allow investors to draw inferences about the management and the decision-usefulness of the disclosure. Credibility assessments evolve from highly subjective processes during which investors simultaneously assess different traits by interpreting perceptually prominent cues (Fogg 2003; Metzger and Flanagin 2015; Rieh 2010). We operationalize management's credibility as investors' composite perceptions of the management's competence (i.e., its ability to provide information that is both accurate and valid) and its honesty (i.e., its willingness to provide information that is both unbiased and truthful) (see e.g., Mercer 2004; 2005; Wang and Tuttle 2014). We operationalize disclosure usefulness as investors' composite subjective assessments of the perceived usefulness, informativeness, and

reliability of a *particular* disclosure (see e.g., Mercer 2004).[2] To investigate how voluntary quantification affects management's credibility, we first examine its impact on investors' perceptions of competence and honesty of the preparer's management. In a second step, we then derive conclusions about the composite effect of voluntary quantification on investors' perceptions of management's credibility and disclosure usefulness.

Prior research indicates that quantification sends an ambiguous signal about competence. While the provision of more precise quantitative information may be interpreted as a cue for competence and confidence (Anderson, Kadous, and Koonce 2004), the same information is likely to be met with skepticism when the provider of the information has incentives to mislead or the quantification is based on subjective input factors (Kadous, Koonce, and Towry 2005). Relatedly, research in enterprise risk management finds that people may perceive the quantification of complex risks as an insufficient characterization of the available information that may signal a poor comprehension of the risk and how it should be managed (Ballou et al. 2011; Power 2009; Stoel et al. 2017). Therefore, even in the presence of high legal and reputational costs, risk quantification is not diagnostic about the management's competence since the management might simply be overconfident or incompetent in assessing the risk.

Attribution theory suggests that the less a preparer's disclosure choices can be explained by situational cues, the more likely investors are to attribute the reason for the disclosure to dispositional traits of the preparer's management (e.g., honesty) (Jones and Davis 1965; Mercer 2005). In particular, attribution theory suggests that disclosures that are inconsistent with managers' incentives are more likely to be attributed to the management's dispositional traits than disclosures that align with their incentives (Dimma 1996; Hughes

---

[2] We draw on Mercer (2004) to develop a composite measure of disclosure usefulness. We argue that investors perceive a disclosure as useful for their decision making if the information reported is perceived as (1) informative: it provides novel information, (2) reliable: the novel information provided can be relied upon, and (3) useful: the novel information is relevant to the investment decision.

1997; Mercer 2005). Quantitative risk measures tend to make the risk more salient with the consequence that the preparer is perceived as riskier (H1). Therefore, because the voluntary disclosure of a quantitative RFD conflicts with the management's incentives, it is likely to increase investors' perceptions of honesty compared to the disclosure of a qualitative RFD. Furthermore, because the entity *voluntarily* provides more precise risk information, quantification can also serve as a social cue (Poggi and D'Errico 2012) that informs investors on the management's social identity (Wolff 2022). That is, since the entity quantifies the risk although it does not have to and although there are potential legal and reputational costs associated with it (Blankespoor, deHaan, and Marinovic 2020), investors are likely to attribute the voluntary quantification to the management's cooperative attitude towards investors.

In summary, while prior research indicates that the disclosure of a quantitative RFD will have an ambiguous effect on investors' perceptions of the management's competence, attribution theory suggests that the disclosure of a quantitative RFD will increase investors' perceptions of the management's honesty. To drive predictions about the composite effect of risk quantification on management's credibility, we rely on research on trait assessment. The latter maintains that because people fail to properly account for the origin of impressions, perceptions of a particular trait are influenced by perceptions of other related traits (Forgas and Laham 2016; Morewedge and Kahneman 2010; Rougier, De Houwer, Richetin, Hughes, and Perugini 2023). Research findings indicate that the assessment of a specific trait can trigger a composite judgment such that cues for one favorable trait automatically induce favorable evaluations of other traits that are deemed associated with the trait under assessment (Cooper 1981; Nisbett and Wilson 1977; Morewedge and Kahneman 2010). Such associative formation of impressions can even result in perceptions without any directly relevant evidence for the perceptions being formed (Morewedge and Kahneman 2010). Therefore, based on research on trait assessment, we conjecture that the positive effects of voluntary quantification on investors'

perceptions of the management's honesty and cooperative attitude will positively affect investors' perceptions of management's competence. That is, we predict that a quantitative RFD will increase investors' perceptions of the management's credibility compared to a qualitative RFD *even though* investors have in fact no means to account for the management's competence in quantifying the risk.

H2: The voluntary disclosure of a quantitative RFD increases investors' perceptions of management's credibility *ceteris paribus*.

Building on H1 and H2, we further theorize that because quantification is voluntary, investors' perceptions will be affected differently depending on whether the RFD-types of the focal and the peer firms match or differ. In the first case (i.e., same RFD-types), the focal and the peer firms disclose both either a quantitative or a qualitative RFD. In the second case (i.e., different RFD-types), the focal firm discloses a quantitative RFD while the peer firm discloses a qualitative RFD or vice versa. When firms disclose different RFD-types, investors receive an additional signal in the form of the contrast between the two RFD-types. The contrast signal shows that there is information missing for one firm. Information that is missing becomes more salient because it attracts investors' attention to information gaps (Golman, Gurney, and Loewenstein 2021; Golman and Loewenstein 2018). This increases the likelihood that investors attend to that information and that they interpret the reasons why the information is missing. The fact that one firm made the effort to quantify while the other did not, is likely to affect investors' interpretations of the two disclosures. That is, investors may be inclined to conclude that the firm that did not provide quantitative information (i.e., reported only a qualitative RFD) may be less honest than the firm that did report a quantitative RFD. In addition, we theorize that the contrast signal will lead investors to perceive a quantitative (qualitative) RFD as more helpful (less helpful) in explaining risk consequences than their peers, which following our argumentation for H2 will positively (negatively) affect perceived

management's credibility. Therefore, we predict that the voluntary quantification in RFDs induces stronger positive attributions to pro-social traits of the management, which in turn, leads to larger appreciations of investors' perceptions of management's credibility when the RFD-types of the focal and the peer firms differ compared to when they match.

H3: Reporting (not reporting) a quantitative RFD results in larger enhancements (impairments) of perceived management's credibility of the preparer when peers abstain from reporting (do report) a quantitative RFD.

In summary, hypothesis 1 predicts that the voluntary disclosure of a quantitative RFD will increase investors' perceived risk. Hypotheses 2 predicts that the voluntary disclosure of a quantitative RFD will increase investors' perceptions of management's credibility. Hypothesis 3 predicts an interaction effect of RFD-type and RFD-contrast on perceived management's credibility. Figure 1 depicts H3 graphically.

III. METHOD

Experimental Design

We test our theory in a 2x2 between-subject design. We manipulate (1) the choice of RFD-type of the focal firm (qualitative vs. quantitative RFD) and (2) RFD-contrast, i.e., whether the focal and the peer firms report the same RFD-types or whether they report different RFD-types (same vs. different RFD-types). In the qualitative RFD-type condition, the focal firm discloses only qualitative risk information. In the quantitative RFD-type condition, the focal firm discloses qualitative information and additionally, quantifies the impact of the risk. That is, the focal firm reports the negative impact of the risk on its profits in case of risk materialization. We operationalize risk quantification as a range of potential negative outcomes
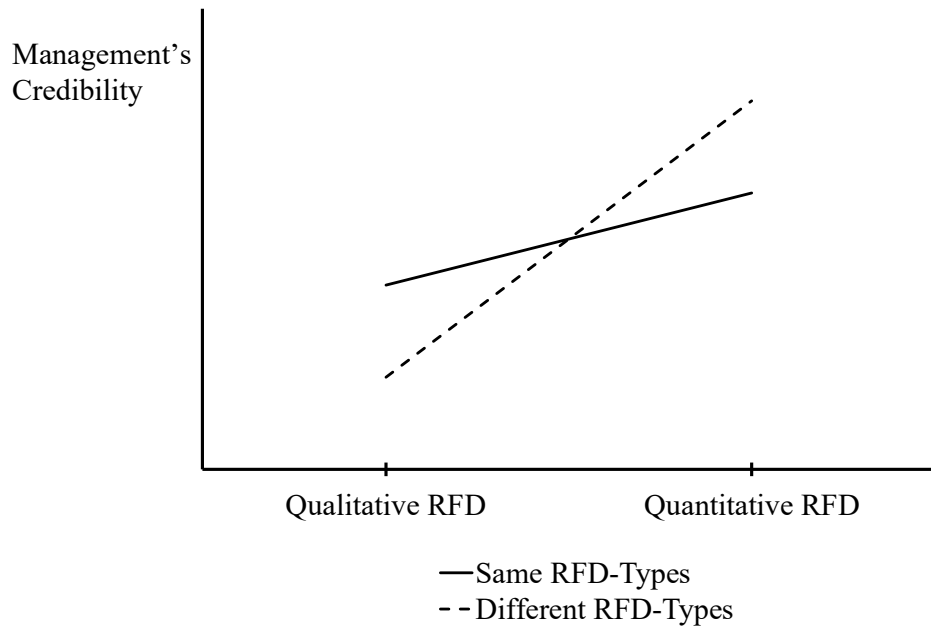
FIGURE 1: Predicted Results of H3

Figure 1 shows the predicted pattern of results for H3. Qualitative RFD and Quantitative RFD refer to the choice of the RFD-type of the focal firm. Same RFD-types and Different RFD-types refer to the RFD-contrast. In the same RFD-types conditions, the focal and the peer firms issue matching RFD-types and in the different RFD-types conditions, the focal and the peer firms issue non-matching RFD-types. Management's Credibility reflects the means of the dependent variables management's competence and management's honesty as reported by participants on a 101-point Likert scale.

on the firm's net income.[3] In the same RFD-types conditions, the focal and the peer firms issue matching RFDs, i.e., they issue both, either a qualitative or a quantitative RFD-type. In the different RFD-types conditions, the focal and the peer firms issue non-matching RFD-types. That is, when the focal firm issues a qualitative (quantitative) RFD-type, the peer firm issues a quantitative (qualitative) RFD-type. We manipulate RFD-type of the focal firm (qualitative vs. quantitative RFD) to examine the incremental effect of the quantification of risk beyond the qualitative disclosure of risk. We manipulate RFD-contrast (same vs. different RFD-types) to

---

[3] We operationalize the risk disclosure via a range of outcomes instead of a single point estimate because range disclosures are more descriptive of the practice of informing on the impact of a risk event (see e.g., Boeing Company 2024; Johnson and Johnson 2023; or 3M Company 2024).

examine investors' reaction to the fact that one firm reports more (or less) helpful information in explaining the consequences of the risk to investors than its peer (See Appendix A for an example of an experimental condition).

Participants

We recruit Amazon Mechanical Turk workers using the platform CloudResearch. We employ two measures to ensure that the participants are good proxies for reasonably informed retail investors and that they dispose of the necessary technical proficiency for the experimental tasks.[4] First, we only recruit participants who attended at least one accounting or finance course at a university level. Second, we apply a screening quiz on RFDs (see materials and procedure for more details). Only participants who answered all questions correctly could access the experiment. We recruited 246 participants in total. Thereof, we excluded 27 participants who failed the comprehension test and 3 participants who took an unreasonable amount of time to finish the experiment.[5] Therefore, our final sample consists of 216 observations.[6]

At the time of the experiment, participants attended on average 2.25 accounting and 2.08 finance courses. Participants are on average 46.87 years old and 1%, 44%, 55% identify their gender as other, women, and men, respectively. Participants lived an average working life of 24.35 years. Seventy-one percent of the participants have previously analyzed financial statements. Seventy-two percent of the participants report having invested in stocks with an average investment experience of 13.62 years. Participants received a fixed compensation of $3.00 for their participation in the experiment. They spent on average 13.28 minutes on the experiment. Therefore, they received an equivalent hourly wage of $13.55.

---

[4] IRB-approval was granted for the experiment by the ethics committee at the authors' institution.

[5] The three participants that were excluded spent 22.67, 52.69 and 106.91 hours on the experiment compared to the participants in our sample who spent on average 13.28 minutes on the experiment.

[6] Our main inferences remain unchanged if we run our analyses on the full sample of 246 participants.

Materials and Procedures

To access the experiment, participants are required to pass a pre-screening quiz. They are informed about the basic features of qualitative and quantitative RFD-types and that firms are free to choose which RFD-type to report. After that, they answer four multiple-choice questions and can access the experiment only if all questions are answered correctly. These questions verify whether participants understand the basic features of the experimental setting, i.e., that firms either report a qualitative or quantitative RFD to inform investors about the preparer's risk that may materialize in the future. Once admitted, participants are informed about the fixed compensation and provide their consent to the analysis and the anonymous publication of the data.

Participants are randomly assigned to one of the four experimental conditions. The experiment consists of three parts: in the first part, instructions inform participants that they will assume the role of a potential investor of ALPHA INC. (the focal firm). They are also informed that they will be provided with ALPHA INC.'s and BETA INC.'s financial disclosures. Participants are explicitly informed that BETA INC. is a perfectly comparable peer firm to ALPHA INC. This allows us to control for the economics of the two firms. In addition, it allows us to control for the content of risk information across the experimental conditions. Since the participants receive RFDs of a focal firm and a perfectly comparable peer firm, they can always learn the quantified risk from one or even both firms' RFDs, except for the baseline condition in which both firms report qualitative RFDs.[7] To provide a clean test of the concerns voiced in the risk management literature, participants received no information about the firms'

---

[7] If for some reason investors believe that qualitative and quantitative RFDs reflect different levels of risk, and investors have access to the quantitative RFDs in some experimental conditions but not in others, the risk information disclosed to investors would clearly vary between conditions. To keep risk information constant across conditions, we chose a design in which participants simultaneously receive RFDs from a focal and a perfectly comparable peer firm. This design allows participants to always learn the quantified risk from one or even both firms' RFDs, except for the baseline condition in which both firms report qualitative RFDs.

competence in quantifying the risk. Finally, participants are informed that both firms strictly abide by all legal and regulatory provisions.

In the second part, we provide participants with background information about ALPHA INC. and BETA INC. along with financial data and the RFD-excerpts. The information is presented on the same page, so that participants view on the left-hand side of the page ALPHA INC.'s information and disclosure and on the right-hand side of the page BETA INC.'s information and disclosure. This parallel representation of the two firms' disclosures is thought to reduce to a minimum the strain investors may experience in comparing the information of the two firms. Depending on the experimental condition, ALPHA INC. reports either a qualitative or a quantitative RFD-type while BETA INC. reports a RFD-type that either matches or differs from the RFD-type reported by ALPHA INC. The risk disclosures inform participants about the risk of a disruption of the supply of raw materials.[8] In the qualitative RFD-setting, the preparer describes the risk and its potential consequences for the firm. In the quantitative RFD-setting, the preparer describes the risk and its potential consequences for the firm, and additionally quantifies the risk. That is, it informs investors of the range within which it expects an interruption in the supply of raw materials to reduce net profit. Participants are then asked to assess several features of the focal firm ALPHA INC.

In the third and final part, participants are asked to answer some post-questionnaire and demographic questions. Finally, participants answer manipulation checks and comprehension test questions. The comprehension test questions require participants to indicate the risk factors that were discussed in the RFD of the focal firm and the peer firm, respectively.

---

[8] The qualitative part of the RFD is adopted from Tan and Yeo (2023).

Dependent Measures

The main dependent measures capture investors' assessments using 101-point Likert scales with 0 and 100 as low and high endpoints. All dependent variables measure investors' assessments of the focal firm ALPHA INC. We ask participants to assess the risk of the focal firm to capture investors' risk perceptions. We elicit investors' risk perceptions by asking them to rate the degree of risk they think the focal firm is exposed to. We elicit investors' perceptions of management's credibility as a mean score of investors' assessment of the perceived competence and the perceived honesty of the management. Specifically, we ask investors to rate the extent to which they agree that (i) the management is competent at providing financial disclosures, (ii) they think the management is honest (Mercer 2005). We measure investment willingness for the focal firm as mean score of investors' willingness to invest and their assessment of the attractiveness of an investment in the focal firm.

IV. RESULTS

Manipulation Checks

We manipulate which RFD-type the focal and the peer firms report (i.e., qualitative vs. quantitative RFD). The manipulation tests verify whether participants attended to our manipulations. 87% (88%) of the participants correctly identified the RFD-type that was reported by the focal firm (peer firm). This indicates that participants attended to our manipulations of the RFD-types of the two firms. Furthermore, 85% of the participants correctly identified both, the focal firm's and peer firm's RFD-type. This suggests that they identified when the RFD-types of the focal and the peer firms matched or did not match. These findings allow us to conclude that the participants took the relevant information about the manipulations of the RFD-types into account. In the manipulated conditions, investors simultaneously receive the RFDs of a focal firm and a perfectly comparable peer firm and at

least one of the two firms reports a quantitative RFD. We chose this setting to assure that the focal firm's economics remain constant between the manipulated conditions. As a manipulation check, we test whether participants' investment willingness for the focal firm did not vary between the manipulated conditions. Following Koonce and Lipe (2010; 2017), we measure investment willingness as a mean score capturing investors' valuation of the focal firm's stock (i.e., investment willingness) and the stocks' attractiveness as an investment (i.e., investment attractiveness) ($\alpha = 0.94$).[9] Table 1 reports the descriptive summary statistics for the construct of investment willingness. Participants reported no significant differences in their investment willingness between the manipulated conditions (omnibus-F-test for differences between treatment groups, all $p > 0.2$, untabulated).[10] These results allow us to conclude that our manipulations worked as intended.

Hypothesis Tests

Hypothesis 1 predicts that the voluntary disclosure of a quantitative RFD increases investors' perceived risk of the focal firm. Table 2 provides the summary descriptive statistics of investors' risk perceptions. Supporting H1, investors assess a higher risk when the focal firm reports a quantitative RFD compared to when it reported a qualitative RFD (62.11 vs. 52.62, $t_{214} = -3.75$, $p < 0.001$, untabulated).[11] Hypothesis 2 predicts that the voluntary disclosure of a quantitative RFD increases investors' perceptions of management's credibility. We elicit management's credibility as a mean score of investors' perceptions of the management's competence and honesty ($\alpha = 0.82$). Table 3 provides the descriptive summary statistics of management's credibility.

---

[9] We define the composite measure investment willingness for ease of exposition.

[10] All p-values reported are two-tailed.

[11] The ANOVA of RFD-type and RFD-contrast on risk shows a significant main effect of RFD-type of the focal firm ($F_{1,212} = 13.20$, $p < 0.001$), a non-significant main effect of RFD-contrast and a non-significant interaction term of RFD-type of the focal firm x RFD-contrast (all p-values > 0.27).

TABLE 1: Descriptive Statistics of Investment Willingness

	Investment Willingness		
	Mean	(SD)	n
Qualitative RFD/Same RFD-types	48.26	(18.99)	58
Qualitative RFD/Different RFD-types	48.03	(15.90)	58
Quantitative RFD/Same RFD-types	52.78	(21.89)	45
Quantitative RFD/Different RFD-types	50.55	(23.30)	55

Qualitative RFD and Quantitative RFD refer to the choice of the RFD-type of the focal firm. Same RFD-types and Different RFD-types refer to the RFD-contrast. In the same RFD-types conditions, the focal and the peer firms issue matching RFD-types and in the different RFD-types conditions, the focal and the peer firms issues non-matching RFD-types. Values reflect the means of the dependent variables investment willingness and investment attractiveness as reported by participants on a 101-point Likert scale. The Cronbach's α is 0.94, indicating good reliability (Nunnally and Bernstein 1994).

As predicted, investors assess a higher management's credibility when the focal firm reports a quantitative RFD compared to when it reports a qualitative RFD (77.60 vs. 60.28, t_{214} = -7.72, $p < 0.001$, untabulated). As a supplementary analysis, we test our prediction that the voluntary disclosure of a quantitative RFD positively influences investors' perceptions of management's competence although investors have no means to evaluate the latter.

In line with our prediction, investors perceive the management as more competent when the focal firm reports a quantitative RFD compared to when it reports a qualitative RFD (78.12 vs. 61.35, t_{214} = -7.05, $p < 0.001$, untabulated). Consistently, investors assess the management as more honest when the focal firm reports a quantitative RFD as compared to when it reports a qualitative RFD (77.08 vs 59.21, t_{214} = -6.91, $p < 0.001$, untabulated). Therefore, our findings provide support for H1 and H2. Next, we examine how the RFD-type of the focal firm (qualitative vs. quantitative RFD) and RFD-contrast (same vs. different RFD-types) jointly affect investors' perceptions of management's credibility.

TABLE 2: Descriptive Statistics of Risk

	Risk		
	Mean	(SD)	n
Qualitative RFD/Same RFD-types	52.60	(18.57)	58
Qualitative RFD/Different RFD-types	52.64	(20.38)	58
Quantitative RFD/Same RFD-types	59.07	(19.73)	45
Quantitative RFD/Different RFD-types	64.60	(15.14)	55

Qualitative RFD and Quantitative RFD refer to the choice of the RFD-type of the focal firm. Same RFD-types and Different RFD-types refer to the RFD-contrast. In the same RFD-types conditions, the focal and the peer firms issue matching RFD-types and in the different RFD-types conditions, the focal and the peer firms issue non-matching RFD-types. Values reflect the means of the dependent variable Risk as reported by participants on a 101-point Likert scale.

Hypothesis 3 predicts an interaction effect between the focal firm's RFD-type (qualitative vs. quantitative RFD) and the RFD-contrast between the focal and the peer firms (same vs. different RFD-types) on investors' perceptions of management's credibility. To test H3 we conduct an ANOVA of the focal firm's RFD-type, RFD-contrast and their interaction on investors' perceptions of management's credibility. The results of the ANOVA are reported in Table 4, Panel A and B. Consistent with H3, we find a significant main effect of RFD-type of the focal firm ($F_{1,212} = 62.26$, $p < 0.001$) and a significant interaction term ($F_{1,212} = 21.41$, $p < 0.001$). We turn to simple effects analysis to test whether the interaction follows the hypothesized pattern. When the focal firm reports a qualitative RFD, investors assess a lower management's credibility when the peer reports a different RFD-type (i.e., a quantitative RFD) as compared to when the peer reports the same RFD-type (i.e., the qualitative RFD) (54.28 vs. 66.28, $F_{1,212} = 16.97$, $p < 0.001$). Conversely, when the focal firm reports a quantitative RFD, investors assess a higher management's credibility when the peer reports a different RFD-type (i.e., a qualitative RFD) compared to when it reports the same RFD-type (i.e., a quantitative RFD) (81.14 vs 73.28, $F_{1,212} = 6.22$, $p = 0.01$).

TABLE 3: Descriptive Statistics of Management's Credibility

	Management's Credibility		
	Mean	(SD)	n
Qualitative RFD/Same RFD-types	66.28	(17.45)	58
Qualitative RFD/Different RFD-types	54.28	(17.29)	58
Quantitative RFD/Same RFD-types	73.28	(14.20)	45
Quantitative RFD/Different RFD-types	81.14	(12.80)	55

Qualitative RFD and Quantitative RFD refer to the choice of the RFD-type of the focal firm. Same RFD-types and Different RFD-types refer to the RFD-contrast. In the same RFD-types conditions, the focal and the peer firms issue matching RFD-types and in the different RFD-types conditions, the focal and the peer firms issue non-matching RFD-types. Values reflect the means of the dependent variables management's competence and management's honesty as reported by participants on a 101-point Likert scale. The Cronbach's α is 0.82, indicating good reliability (Nunnally and Bernstein 1994).

Interestingly, this results in the paradoxical effect that the quantitative RFD of a focal firm leads investors to perceive a lower management's credibility when both, the focal and the peer firms provide quantitative RFDs compared to the case when only the focal firm discloses a quantitative RFD, and the peer reports a qualitative RFD. These findings provide supportive evidence for H3.

Supplementary Analyses

We conduct additional analyses using a moderated mediation model to examine how RFD-type of the focal firm and RFD-contrast jointly affect investors' perceptions of disclosure usefulness. Disclosure usefulness captures investors' subjective assessments of the decision-usefulness of a particular disclosure (see e.g., Mercer 2004). The process model presented in Figure 2 describes the hypothesized links between all relevant variables as a moderated sequential mediation relationship of RFD-type on perceived disclosure usefulness.

Our theory suggests that a quantitative RFD sends a dual signal to investors, i.e., an economic signal about the focal firm's risk and a social signal about the focal firm's social

TABLE 4: ANOVA on Management's Credibility

Panel A: Conventional ANOVA

Source	df	MS	F-statistic	p-value
RFD-type of the focal firm (Qualitative vs. Quantitative RFD)	1	15304.16	62.26	< 0.001
RFD-contrast (Same vs. Different RFD-types)	1	228.08	0.93	0.34
RFD-type of the focal firm × RFD-contrast	1	5261.56	21.41	< 0.001
Error	212	245.80		

Panel B: Simple Effects

Comparison	df	F-statistic	p-value
Qualitative vs. Quantitative RFD (given Same RFD-types)	1	5.05	0.03
Qualitative vs. Quantitative RFD (given Different RFD-types)	1	82.81	< 0.001
Same vs. Different RFD-types (given Qualitative RFD)	1	16.97	< 0.001
Same vs. Different RFD-types (given Quantitative RFD)	1	6.22	0.01

――――――――――――――――――

Qualitative RFD and Quantitative RFD refer to the choice of the RFD-type of the focal firm. Same RFD-types and Different RFD-types refer to the RFD-contrast. In the same RFD-types conditions, the focal and the peer firms issue matching RFD-types and in the different RFD-types conditions, the focal and the peer firms issue non-matching RFD-types. RFD-type of the focal firm is a dummy variable coded "0" for the Qualitative RFD and "1" for the Quantitative RFD. RFD-contrast is a dummy variable coded "0" for the Same RFD-types and "1" for the Different RFD-types. Management's Credibility reflects the means of the dependent variables management's competence and management's honesty as reported by participants on a 101-point Likert scale. The Cronbach's α is 0.82, indicating good reliability (Nunnally and Bernstein 1994). All p-values reported are two-tailed.

identity. Prior research consistently found that the credibility of a source positively affects persuasion towards its message (see e.g., Pornpitakpan 2004 for a review on these studies). For the disclosure setting, research findings indicate that the higher the management's credibility and the more precise the information that is provided, the more investors tend to be confident about the signal (Mercer 2004). Our model suggests that as an economic signal, a quantitative RFD provides more precise and comprehensible information on the downside risk of a firm. Therefore, it is likely to increases investors' perceptions of disclosure usefulness via investors' increased risk perceptions (H1, path 1: Link 1 and Link 4).
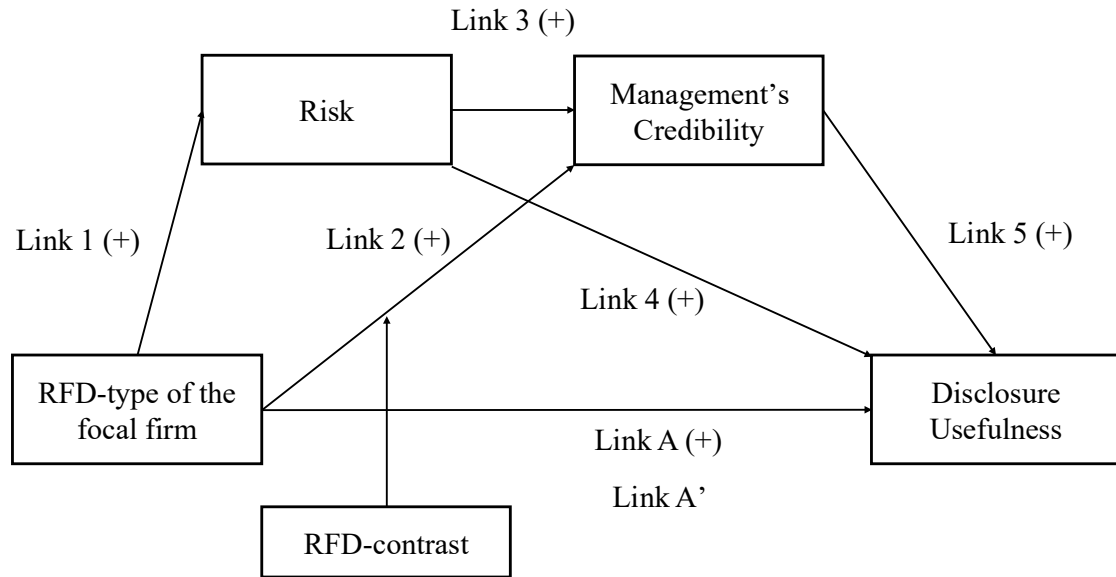
FIGURE 2: Conditional Process Model

Figure 2 depicts the predicted paths of the theoretical process model. The predicted sign of each link is indicated in parenthesis.

Path 1: RFD-type of the focal firm → Risk → Disclosure Usefulness.

Path 2: RFD-type of the focal firm x RFD-contrast → Management's Credibility → Disclosure Usefulness.

Path 3: RFD-type of the focal firm → Risk → Management's Credibility → Disclosure Usefulness.

As a social signal, a quantitative RFD increases investors' perceptions of disclosure usefulness through its impact on management's credibility via two distinct paths. First, via investors' attribution of the motive for the disclosure to pro-social traits of the management (H2, path 2: Link 2 and Link 5). And second, additionally, through the interpretation and attribution of investors' increased risk perceptions to the credibility of the preparer's management (H2, path 3: Links 1, Link 3, and Link 5). Furthermore, our theory posits that the social signal influences perceived management's credibility more strongly when the two firms report different RFD-types compared to when they report the same RFD-types (H3). We operationalize H3 by suggesting that the impact of a quantitative RFD on investors' perceptions of management's credibility (Link 2) is moderated by RFD-contrast, i.e., whether the two firms report the same or different RFD-types. Taken together, our theory predicts a moderated

sequential mediation relationship of RFD-type on perceived disclosure usefulness, with perceived risk and perceived management's credibility as sequential mediators, where RFD-contrast moderates the effect of RFD-type on perceived management's credibility, resulting in a higher (lower) disclosure usefulness when the focal and the peer firms report different (the same) RFD-types.

To test our theoretical model, we run a bootstrap-based moderated sequential mediation model using the PROCESS macro by Hayes (2022) in the statistical software SPSS. We elicit investors' assessments of disclosure usefulness via a composite measure of the perceived usefulness, the perceived informativeness, and the perceived reliability of the RFD ($\alpha = 0.92$). Table 5 reports the results of the moderated mediation. Figure 3 presents graphically the results for the hypothesized paths of the model.

Our results are consistent with our theory and the proposed conditional process model (see Figure 2). We find empirical evidence for all three paths of the model. Our results show that the effect of RFD-type on disclosure usefulness is sequentially mediated by investors' perceptions of risk and subsequently by their perceptions of management's credibility (path 3: Link 1, Link 3, and Link 5) (Coeff: 1.70, SE: 0.64, 95% CI: [0.62, 3.09], Table 5, Panel E).[12] As predicted, inspection of the individual effects (Table 5, Panel A) shows that a quantitative RFD increases risk perceptions (Link 1) (Coeff: 9.49, SE: 2.53, 95% CI: [4.5, 14.48]), that heightened risk perceptions induce increased perceptions of management's credibility (Link 3) (Coeff: 0.26, SE: 0.06, 95% CI: [0.15, 0.37]) and that increased perceptions of management's credibility lead to increased perceptions of disclosure usefulness (Link 5) (Coeff: 0.69, SE: 0.06, 95% CI: [0.58, 0.80]).

---

[12] There is a clear consensus in the literature that demonstrating the insignificance of the direct effect after inclusion of the mediators into the model is no longer considered a necessary condition to establish mediation (Jollineau and Bowen 2023; Preacher and Hayes 2004; 2008; Zhao, Lynch, and Chen 2010).

Panel A: Individual Effects

	Effect	SE	Lower 95% CI	Upper 95% CI
Link A (before mediations): Qualitative vs. Quantitative RFD → Disclosure Usefulness	20.50	2.45	15.67	25.32
Link A' (after mediations): Qualitative vs. Quantitative RFD → Disclosure Usefulness	7.09	2.00	3.15	11.03
Link 1: Qualitative vs. Quantitative RFD → Risk	9.49	2.53	4.50	14.48
Link 2: Qualitative vs. Quantitative RFD → Management's Credibility	5.32	2.99	-0.58*	11.22*
Link 3: Risk → Management's Credibility	0.26	0.06	0.15	0.37
Interaction: Qualitative vs. Quantitative RFD X RFD-contrast → Management's Credibility	18.42	4.10	10.33	26.51
Link 4: Risk → Disclosure Usefulness	0.15	0.05	0.06	0.25
Link 5: Management's Credibility → Disclosure Usefulness	0.69	0.06	0.58	0.80

Panel B: Conditional Effects of RFD-type of the Focal Firm

	Effect	SE	Lower 95% CI	Upper 95% CI
Effect of Qualitative vs. Quantitative RFD on Management's Credibility when the RFD-contrast is *Same RFD-types*	5.32	2.99	-0.58*	11.22*
Effect of Qualitative vs. Quantitative RFD on Management's Credibility when the RFD-contrast is *Different RFD-types*	23.75	2.89	18.04	29.45

Panel C: Partial Indirect Effect

	Effect	SE	Lower 95% CI	Upper 95% CI
Path 1 (Links 1 and 4): Qualitative vs. Quantitative RFD → Risk → Disclosure Usefulness	1.47	0.70	0.36	3.06

Panel D: Moderated Partial Indirect Effects

	Effect	SE	Lower 95% CI	Upper 95% CI
Path 2a (Links 2 and Link 5): Qualitative vs. Quantitative RFD → Management's Credibility → Disclosure Usefulness when the RFD-contrast is *Same RFD-types*	3.67	2.11	-0.62	7.64
Path 2b (Link 2 and Link 5): Qualitative vs. Quantitative RFD → Management's Credibility → Disclosure Usefulness when the RFD-contrast is *Different RFD-types*	16.37	2.41	11.72	21.13

Index of Moderated Mediation	12.70	3.23	6.78	19.23

Panel E: Total Indirect Effect				
	Effect	SE	Lower 95% CI	Upper 95% CI
Path 3 (Links 1, Link 3, and Link 5): Qualitative vs. Quantitative RFD → Risk → Management's Credibility → Disclosure Usefulness	1.70	0.64	0.62	3.09

Table 5 presents the results of the moderated mediation model. We test this model using Hayes' (2022) PROCESS macro in SPSS. Qualitative RFD and Quantitative RFD refer to the choice of the RFD-type of the focal firm. Same RFD-types and Different RFD-types refer to the RFD-contrast. In the same RFD-types conditions, the focal and the peer firms issue matching RFD-types and in the different RFD-types conditions, the focal and the peer firms issue non-matching RFD-types. RFD-type of the focal firm is a dummy variable coded "0" for the Qualitative RFD and "1" for the Quantitative RFD. RFD-contrast is a dummy variable coded "0" for the Same RFD-types and "1" for the Different RFD-types. Risk reflects the means of this variable as reported by participants on a 101-point Likert scale. Management's Credibility reflects the means of the dependent variables management's competence and management's honesty as reported by participants on a 101-point Likert scale. The Cronbach's α is 0.82, indicating good reliability (Nunnally and Bernstein 1994). Disclosure Usefulness reflects the means of the dependent variables disclosure usefulness, disclosure informativeness and disclosure reliability as reported by participants on a 101-point Likert scale. The Cronbach's α is 0.92, indicating good reliability (Nunnally and Bernstein 1994). Panel A reports the individual effects of the model. Link A reports the coefficient of the RFD-type of the focal firm on Disclosure Usefulness *before* the mediations. Link A' presents the estimate for Link A after the mediations. Panel B reports the effect of RFD-type of the focal firm on Management's Credibility at different levels of RFD-contrast. Panel C reports the results of the mediation of the effect of RFD-type of the focal firm on Disclosure Usefulness via Risk (Path 1). Panel D reports the results of the moderated mediation of the effect of RFD-type of the focal firm on Disclosure Usefulness via Management's Credibility at different levels of RFD-contrast (Path 2). The index of moderated mediation tests whether the difference between the conditional indirect effects is statistically significant. Panel E reports the results of the sequential mediation of the effect of RFD-type of the focal firm on Disclosure Usefulness via Risk, and sequentially, via Management's Credibility (Path 3). The bootstrapping confidence interval follows from 5'000 iterations.

* denotes marginal significance for those coefficients whose confidence interval contains 0.

We also find support for path 1 (Link 1 and Link 4), i.e., that the effect of RFD-type on disclosure usefulness is mediated by investors' risk perceptions (Coeff: 1.47, SE: 0.70, 95% CI: [0.36, 3.06], Table 5, Panel C).

Finally, we find evidence consistent with our hypothesis that the mediation of RFD-

type on disclosure usefulness by management's credibility is moderated by RFD-contrast (path 2: Link 2 and Link 5, Table 5, Panel D). That is, when the focal and the peer firms report different RFD-types, a quantitative RFD leads to increased perceptions of management's credibility, which, in turn, positively influences perceptions of disclosure usefulness (Coeff: 16.37, SE: 2.41, 95% CI: [11.72, 21.13]). However, when the focal and the peer firms report the same RFD-types, we do not find support for this mediation (Coeff: 3.67, SE: 2.11, 95% CI: [-0.62, 7.64]). Consistent with our predicted interaction, the index of moderated mediation indicating that the two indirect effects are different (i.e., same vs. different RFD-types) is significant (index = 12.70, SE: 3.23, 95% CI: [6.78, 19.23]). Taken together, our findings provide empirical support for our theory on how RFD-type and RFD-contrast jointly affect investors' perceptions of disclosure usefulness.

V. CONCLUSIONS

We investigate how the voluntary provision of quantitative RFDs affects investors' perceptions of preparers' risk, the credibility of their management, and the usefulness of their disclosures. Based on attribution theory, we predict and find that quantitative RFDs increase investors' risk perceptions. We also find that absent obvious motives for the voluntary quantification, investors tend to attribute the cause for the quantification to presumed pro-social personality traits of the preparer's management. Therefore, investors perceive the management as more credible and its disclosure as more useful when the preparer reports a quantitative RFD as compared to when it reports a qualitative RFD. This holds even though investors have no means to assess the preparer's competence in quantifying the risk. We further predict and find that investors' associative formation of perceptions interacts with peer disclosure. That is, the possibility (impossibility) to attribute a peer's RFD to pro-social traits of its management, decreases (increases) investors' perceptions about the focal firm *independent* of the RFD-type the focal firm reports.

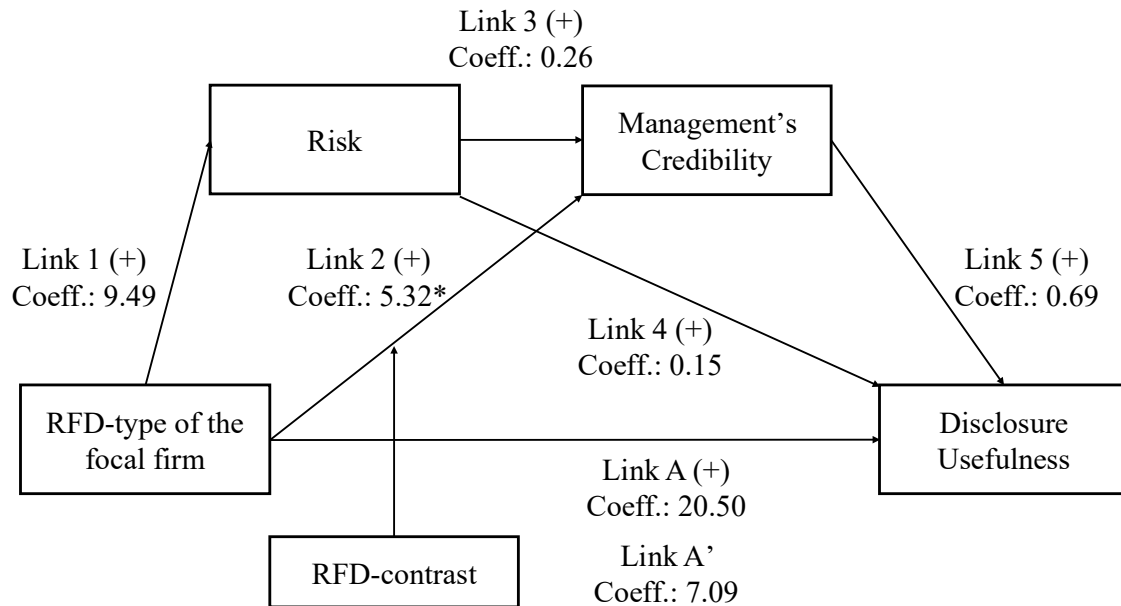**FIGURE 3: Conditional Process Model - Results**

Figure 3 exhibits the predicted mediation model and the estimated path coefficients using the PROCESS macro (Hayes 2022) in the statistical software SPSS. The model shows a mediation of the effect of RFD-type of the focal firm on Disclosure Usefulness via Risk (path 1), a mediation of the effect of RFD-type of the focal firm on Disclosure Usefulness via Management's Credibility moderated by RFD-contrast (path 2), and a sequential mediation of the effect of RFD-type of the focal firm on Disclosure Usefulness via Risk and, subsequently, via Management's Credibility (path 3). Link A reports the coefficient of the RFD-type of the focal firm on Disclosure Usefulness before the mediations. Link A' presents the estimate for Link A after the mediations. The values provided for each link represent the coefficient of the individual effect (all links are significant, i.e. the 95% confidence interval does not contain 0, except link 2).

* denotes marginal significance (the coefficient's confidence interval contains 0).

Therefore, our results suggest that investors' perceptions of the credibility and the competence of the preparer tend to increase (and decrease) when the latter is more (or less) helpful than its peer in explaining the consequences of the risk on firm metrics. Our results indicate that investors' perceptions increase with the disclosure of quantitative RFDs, without investors accounting for the quality of the quantitative risk information that they impound into their assessments.

We believe that our findings are of interest for academics, standard setters, investors,

and preparers. First, we do not find any support for the concerns voiced in the risk management literature that people tend to be inherently distrustful towards the quantification of risk or that they may interpret the quantification of risk factors as evidence for managerial overconfidence and incompetence. Second, we provide empirical evidence that the voluntary provision of quantified RFDs can induce investors to immerse in the associative formation of impressions about the credibility of a preparer's management and its disclosure *before* critically assessing the latter's competence in quantifying the risk. From a practical perspective, the lack of investor skepticism towards preparers' risk quantifications can be problematic when preparers lack the competence to quantify risk or when they purposefully misrepresent risk information. Therefore, our study encourages investors to carefully seek for information on the competence of preparers in quantifying risk before assessing the credibility of its management or the usefulness of its disclosure. It also informs regulators that the disclosure of such information could be helpful to investors. Third, since the effectiveness of social signaling seems to be inversely related to the number of preparers reporting a quantitative RFD, our research informs preparers about the boundary conditions for influencing investors' perceptions of credibility and competence via quantitative RFDs. Moreover, our results alert regulators and preparers to the disadvantage of mandating quantitative RFDs in terms of preparers' attempts to build or enhance credibility with investors.

Our findings offer several opportunities for future research. Participants in our study received no information on the management's competence in quantifying risk. Moreover, firm economics between the focal and the peer firms were held constant. Future research could examine how imperfect signals of managerial competence and/or asymmetries in economic firm fundamentals may affect the impact of social signaling through quantitative RFDs on investors' perceptions of risk, management's credibility, and disclosure usefulness. Researchers may also be interested in investigating potential trade-offs between increasing

investors' risk perceptions and enhancing management's credibility when reporting quantitative RFDs. Future research could also examine the effect of quantitative RFDs on assessments of the preparer made by financial analysts, customers, suppliers, and employees.

Our study is not without limitations. Our results rely on a simplified experimental design that eliminates many of the complexities of real-world risk reporting. In practice, investors most likely have access to a wider range of information to form perceptions about the preparer's risk, its management's credibility, and the decision-usefulness of a specific risk disclosure. However, apart from this limitation, we provide theory and initial empirical evidence on the psychological processes through which the voluntary disclosure of quantitative risk estimates in RFDs affects investors' risk perceptions, their perceptions of the credibility of the preparer's management and decision-usefulness of the risk disclosure.

REFERENCES

Anderson, U., K. Kadous, and L. Koonce. 2004. The Role of Incentives to Manage Earnings and Quantification in Auditors' Evaluations of Management-Provided Information. *Auditing: A Journal of Practice & Theory* 23 (1): 11–27.

Ballou, B., D.L. Heitger, and D. Stoel. 2011. How Boards of Directors Perceive Risk Management Information. *Management Accounting Quarterly* 12 (4): 14–22.

Bao, Y., and A. Datta. 2014. Simultaneously Discovering and Quantifying Risk Types from Textual Risk Disclosures. *Management Science* 60 (6): 1371–1391.

Beatty, A., L. Cheng, and H. Zhang. 2019. Are Risk Factor Disclosures Still Relevant? Evidence from Market Reactions to Risk Factor Disclosures Before and After the Financial Crisis. *Contemporary Accounting Research* 36 (2): 805–838.

Blankespoor, E., E. deHaan, and I. Marinovic. 2020. Disclosure processing costs, investors' information choice, and equity market outcomes: A review. *Journal of Accounting and Economics* 70 (2-3): Article 101344.

Boeing Company. 2024. *Form 10-K*. Available at: https://d18rn0p25nwr6d.cloudfront.net/CIK-0000012927/9ae3a46b-0c45-42eb-8e9b-ad5fc5277664.pdf (last accessed February 8, 2024).

Bordalo, P., N. Gennaioli, and A. Shleifer. 2022. Salience. *Annual Reviews of Economics* 14: 521–544.

Campbell, J.L., H. Chen, D.S. Dhaliwal, H.M. Lu, and L.B. Steele. 2014. The information content of mandatory risk factor disclosures in corporate filings. *Review of Accounting Studies* 19: 396–455.

Cooper, W.H. 1981. Ubiquitous halo. *Psychological Bulletin* 90 (2): 218–244.

Dimma, W.A. 1996. Executive compensation gets its share. *Business Quarterly* 61 (1): 77–80.

Fogg, B.J. 2003. Prominence-interpretation theory: explaining how people assess credibility online. In *CHI'03 Extended Abstracts on Human Factors in Computer Systems* (CHI EA '03). Association for Computing Machinery, New York, NY, USA, 722–723.

Forgas, J.P., and S.M. Laham. 2016. Halo effects. In *Cognitive Illusions: Intriguing Phenomena in Judgment, Thinking and Memory*, edited by R.F. Pohl, 276–290. Second Edition. London, UK: Psychology Press.

Glaser, M., Z. Iliewa, and M. Weber. 2019. Thinking about Prices versus Thinking about Returns in Financial Markets. *The Journal of Finance* 74 (6): 2997–3039.

Golman, R., and G. Loewenstein. 2018. Information gaps: A theory of preferences regarding the presence and absence of information. *Decision* 5 (3): 143–164.

Golman, R., N. Gurney, and G. Loewenstein. 2021. Information Gaps for Risk and Ambiguity. *Psychological Review* 128 (1): 86–103.

Graham, B., and D.L. Dodd. 2023. *Security analysis. Principles and technique*, edited by S.A. Klarman. Seventh Edition. New York, NY, USA: McGraw-Hill.

Hayes, A.F. 2022. *Introduction to Mediation, Moderation, and Conditional Process Analysis. A Regression-Based Approach.* Third Edition. New York, NY, USA: The Guilford Press.

Histen, M.J. 2022. Taking Information Seriously: A Firm-side Interpretation of Risk Factor Disclosure. *International Advances in Economic Research* 28: 119–131.

Hope, O-K., D. Hu, and H. Lu. 2016. The benefits of specific risk-factor disclosures. *Review of Accounting Studies* 21: 1005–1045.

Hughes, J.V. 1997. How Does Your Pay Stack Up? *Financial Executive* 13 (3): 24–26.

Johnson and Johnson. 2023. *Form 10-K*. Available at: https://d18rn0p25nwr6d.cloudfront.net/CIK-0000200406/2d8bead4-a89a-4802-8c63-1266ad78e6a2.pdf (last accessed February 8, 2024).

Jollineau, J.S., and R.M. Bowen. 2023. A Practical Guide to Using Path Analysis: Mediation and Moderation in Accounting Research. *Journal of Financial Reporting* 8 (1): 11–40.

Jones, E.E., and K.E. Davis. 1965. From acts to dispositions: The attribution process in person perception. In *Advances in Experimental Social Psychology,* edited by L. Berkowitz, 2: 220–266. New York, NY, USA: Academic Press.

Kadous, K., L. Koonce, and K.L. Towry. 2005. Quantification and Persuasion in Managerial Judgement. *Contemporary Accounting Research* 22 (3): 643–686.

Koonce, L., M.L. McAnally, and M. Mercer. 2005. How Do Investors Judge the Risk of Financial Items? *The Accounting Review* 80 (1): 221–241.

Koonce, L., and M.G. Lipe. 2010. Earnings Trend and Performance Relative to Benchmarks: How Consistency Influences Their Joint Use. *Journal of Accounting Research* 48 (4): 859–884.

Koonce, L., and M.G. Lipe. 2017. Firms with Inconsistently Signed Earnings Surprises: Do Potential Investors Use a Counting Heuristic? *Contemporary Accounting Research* 34 (1): 292–313.

Kravet, T., and V. Muslu. 2013. Textual risk disclosures and investors' risk perceptions. *Review of Accounting Studies* 18: 1088–1122.

Marks, H. 2022. Talks at GS 2022. Available at: https://de.slideshare.net/gangesh/transcriptpdf-252537706 (last accessed January 13, 2024).

Mercer, M. 2004. How Do Investors Assess the Credibility of Management Disclosures? *Accounting Horizons* 18 (3): 185–196.

Mercer, M. 2005. The Fleeting Effects of Disclosure Forthcomingness on Management's Reporting Credibility. *The Accounting Review* 80 (2): 723–744.

Metzger, M.J., and A.J. Flanagin. 2015. Psychological Approaches to Credibility Assessment Online. In *The Handbook of the Psychology of Communication Technology*, edited by S.S. Sundar, 445-466. Chichester, West Sussex, UK: John Wiley & Sons.

Moon, K. 2020. The Effect of Managers' Risk Perceptions on Risk Factor Disclosures. Doctoral dissertation, University of Washington. Available at: https://digital.lib.washington.edu/researchworks/items/f6183453-87f2-42f6-ab18-baced75ca64d (last accessed December 27, 2023).

Morewedge, C.K., and D. Kahneman. 2010. Associative processes in intuitive judgment. *Trends in Cognitive Sciences* 14 (10): 435–440.

Newall, P.W.S., and L. Weiss-Cohen. 2022. The Gamblification of Investing: How a New Generation of Investors is Being Born to Lose. *International Journal of Environmental Research and Public Health* 19 (9): 1–10.

Nisbett, R.E., and T.D. Wilson. 1977. The Halo Effect: Evidence for Unconscious Alteration of Judgments. *Journal of Personality and Social Psychology* 35 (4): 250–256.

Nunnally, J.C., and I.H. Bernstein. 1994. *Psychometric Theory*. Third Edition. New York, NY, USA: McGraw-Hill.

Poggi, I., and F. D'Errico. 2012. Social signals: a framework in terms of goals and beliefs. *Cognitive Processing* 13 (Supplement 2): 427–445.

Pornpitakpan, C. 2004. The Persuasiveness of Source Credibility: A Critical Review of Five Decades' Evidence. *Journal of Applied Social Psychology* 34 (2): 243–281.

Power, M. 2009. The risk management of nothing. *Accounting, Organizations and Society* 34: 849–855.

Preacher, K.J., and A.F. Hayes. 2004. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers* 36 (4): 717–731.

Preacher, K.J., and A.F. Hayes. 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods* 40 (3): 879–891.

Rieh, S.Y. 2010. Credibility and Cognitive Authority of Information. In *Encyclopedia of Library and Information Sciences*, edited by M.J. Bates, and M.N. Maack, 1337–1344. Third Edition. New York, NY, USA: Taylor and Francis Group.

Rougier, M., J. De Houwer, J. Richetin, S. Hughes, and M. Perugini. 2023. From Halo to Conditioning and Back Again: Exploring the Links Between Impression Formation and Learning. *Collabra: Psychology* 9 (1): 1–26.

Securities and Exchange Commission (SEC). 2005. *Securities Offering Reform.* Final rule. Release Nos. 33-8591; 34-52056; IC-26993; FR-75; International Series Release No. 1294; File No. S7-38-04. Washington, D.C. Available at: http://www.sec.gov/rules/final/33-8591.pdf (last accessed December 27, 2023).

Securities and Exchange Commission (SEC). 2016. *Business and Financial Disclosure Required by Regulation S-K.* Concept release. (Release No. 33-10064; 34-77599; File No. S7-06-16). Washington, D.C. Available at: www.sec.gov/rules/2016/04/business-and-financial-disclosure-required-regulation-s-k (last accessed: February 13, 2024).

Stoel, D.M., B. Ballou, and D.L. Heitger. 2017. The Impact of Quantitative versus Qualitative Risk Reporting on Risk Professionals' Strategic and Operational Risk Judgments. *Accounting Horizons* 31 (4): 53–69.

Tan, H., and F. Yeo. 2023. You have been forewarned! The effects of risk management disclosures and disclosure tone on investors' judgments. *Accounting, Organizations and Society* 105: Article 101400.

Taylor, S.E., and S.C. Thompson. 1982. Stalking the Elusive "Vividness" Effect. *Psychological Review* 89 (2): 155–81.

Wang, L., and B. Tuttle. 2014. Using corporate social responsibility performance to evaluate financial disclosure credibility. *Accounting and Business Research* 44 (5): 523–544.

Williams, P.A. 1996. The Relation Between a Prior Earnings Forecast by Management and Analyst Response to a Current Management Forecast. *The Accounting Review* 71 (1): 103–115.

Wolff, A. 2022. Signaling the value of social identity. Working paper, University of Strasbourg. Available at: www.ideas.repec.org/p/ulp/sbbeta/2022-15.html (last accessed December 27, 2023).

Zhao, X., J.G. Lynch, Jr., and Q. Chen. 2010. Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research* 37 (2): 197–206.

3M Company. 2024. *Form 10-K*. Available at: https://investors.3m.com/financials/sec-filings/content/0000066740-24-000016/0000066740-24-000016.pdf (last accessed February 8, 2024).

APPENDIX A

Example of an Experimental Condition

[Quantitative RFD + Different RFD-Types]

ALPHA INC.		BETA INC.	
Financial data 20x1 (in million)		**Financial data 20x1 (in million)**	
Total assets	3'000	**Total assets**	3'000
Net income (before taxes)	425	**Net income (before taxes)**	425

Risk factor disclosure 20x1

Risk of raw material supply disruption

We rely on the supply of organic raw materials from third-party producers located in different world areas. In fact, a disruption in the supply of raw materials from current sources will disrupt our production. We do not have control over our suppliers. In the event of a disruption, our production may be discontinued. Delays and interrupted raw materials supply at unreasonable costs could lead us to fail to meet customer demand for our products, damage our branding and suffer financial losses.
In the event of a raw material supply disruption, we expect a negative impact on the net income between 110 and 140 million $.

Risk factor disclosure 20x1

Risk of raw material supply disruption

We rely on the supply of organic raw materials from third-party producers located in different world areas. In fact, a disruption in the supply of raw materials from current sources will disrupt our production. We do not have control over our suppliers. In the event of a disruption, our production may be discontinued. Delays and interrupted raw materials supply at unreasonable costs could lead us to fail to meet customer demand for our products, damage our branding and suffer financial losses.

In the experimental condition "Quantitative RFD + Different RFD-Types" participants view that the RFD-type of the focal firm is quantitative (left-hand side), whereas the RFD-type of the peer firm is qualitative (right-hand side).

STATEMENT OF AUTHORSHIP

Ich erkläre hiermit, dass ich diese Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen benutzt habe. Alle Koautorenschaften sowie alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet. Mir ist bekannt, dass andernfalls der Senat gemäss Artikel 36 Absatz 1 Buchstabe o des Gesetzes vom 5. September 1996 über die Universität zum Entzug des aufgrund dieser Arbeit verliehenen Titels berechtigt ist.

Ort, Datum   Unterschrift

 Bern, 19/12/2024   Alessandro Cortese