



**Dr. Hebatallah Abd El Salam
Badawy¹**

Assistant Professor of Accounting
and Auditing – Faculty of Commerce
– Alexandria University

Associate Professor of Accounting and
Auditing – Egypt Japan University of
Science and Technology (E-JUST)

The Impact of Assurance Quality and Level on Cybersecurity Risk Management Program on Non- Professional Egyptian Investors’ Decisions: An Experimental Study

Abstract

The objective of this study is to examine and analyze the impact of assurance quality (measured by the size of the audit firm performing this assurance; Big4 auditor vs. non-Big4) and assurance level (reasonable vs. limited assurance) on cybersecurity risk management program on non-professional investors’ willingness to invest and their stock valuation. To fulfil the research objective, a 2X2 between-subjects experiment was designed to test the research hypotheses.

Based on a sample of 64 MBA and postgraduate students in the Faculty of Commerce, Alexandria University and ESLSCA University, the researcher found evidence that high assurance quality (Big4 auditor) and reasonable assurance level conveyed in the assurance report on cybersecurity risk management program have a significant and positive effect on investors’ willingness to invest and their stock valuation. However, the researcher didn’t find significant difference in investors’ willingness to invest or their stock valuation in case a limited assurance report is offered by a Big4 audit firm in comparison with the case of a reasonable assurance report offered by a non-Big4 audit firm. This study adds an experimental evidence to the literature on non-audit services and cybersecurity and will help in reducing the accounting research gap related to cybersecurity risk management program, which is consistent with the Egyptian government’s efforts and attention paid to cybersecurity and its related risks.

Keywords: cybersecurity, assurance quality, assurance level, non-professional investors, Egypt.

أثر جودة ومستوى التوكيد على برنامج إدارة مخاطر الأمن السيبراني على قرارات المستثمرين المصريين غير المحترفين: دراسة تجريبية

ملخص البحث

يهدف هذا البحث إلى اختبار وتحليل أثر جودة التوكيد (المقاسة من خلال حجم مكتب المراجعة الذي يوفر هذا التوكيد، مكتب مراجعة ينتمي إلى إحدى مكاتب المراجعة الأربعة الكبار في مقابل مكتب مراجعة آخر بخلاف هذه المكاتب) ومستوى التوكيد (توكيد معقول في مقابل توكيد محدود) على برنامج إدارة مخاطر الأمن السيبراني على رغبة المستثمرين غير المحترفين في الاستثمار وتقييمهم لأسهمهم. ولتحقيق هدف البحث، تم تصميم تجربة 2X2 لاختبار فروض البحث.

بناءً على عينة مكونة من ٦٤ طالب في ماجستير إدارة الأعمال المهنية والدراسات العليا في كلية التجارة بجامعة الإسكندرية وجامعة اسلسكا، وجد الباحث دليلاً على أن لجودة التوكيد المرتفعة (موفر التوكيد ينتمي إلى إحدى مكاتب المراجعة الأربعة الكبار) ومستوى التوكيد المعقول تأثير جوهري وإيجابي على رغبة المستثمرين في الاستثمار وتقييمهم لأسهمهم. ومع ذلك، لم يجد الباحث اختلافاً كبيراً في رغبة المستثمرين في الاستثمار أو في تقييم لأسهمهم بين الحالة التي يتم فيها توفير تقرير توكيد محدود من قبل مكتب مراجعة ينتمي إلى إحدى مكاتب المراجعة الأربعة الكبار وبين الحالة التي يتم فيها توفير تقرير توكيد معقول من قبل مكتب مراجعة آخر بخلاف إحدى مكاتب المراجعة الأربعة الكبار. يضيف هذا البحث دليلاً تجريبياً إلى الدراسات السابقة في مجال الخدمات الأخرى بخلاف المراجعة والأمن السيبراني، وسيساعد في توضيح فجوة البحث المحاسبي المتعلقة ببرنامج إدارة الأمن السيبراني، وهو ما يتماشى مع جهود الحكومة المصرية والاهتمام الذي توليه للأمن السيبراني والمخاطر ذات الصلة.

الكلمات المفتاحية: الأمن السيبراني، جودة التوكيد، مستوى التوكيد، مستثمرين غير محترفين، مصر.

1. Introduction

All companies are now storing their sensitive data on networks and in the cloud, and this makes cybersecurity very important to regulators, managers, non-professional investors and board members (Frank et al., 2019). Meanwhile, the global business environment is now forcing companies to maintain secure digital infrastructure to conduct their business transactions. The inter-connected digital infrastructure is called cyberspace and it includes the internet, computer systems, hardware, software and digital information. This cyberspace is important for e-commerce, e-government and other electronic transactions (Kahyaoglu & Caliyurt, 2018).

While organizations are trying to eliminate cybersecurity risks, they can't achieve complete security (Bodin et al., 2018). Because such risks are of paramount importance and may have a severe impact on the businesses' operations and market position, stakeholders are asking for cybersecurity disclosures to reduce the level of information asymmetry. Meanwhile, these disclosures are of little value until they are examined by an independent assurance provider (assuror). Accordingly, stakeholders in general and investors in particular are seeking assurance that the company is making rational investment decisions concerning its cybersecurity risk management (Bodin et al., 2018).

Based on the above discussion, it can be noticed that cybersecurity is becoming of paramount importance to regulators, shareholders, customers and academics (Pandey et al., 2020; Walton et al., 2021). People, governments and businesses are now conducting business transactions using information technology and this will increase the prevalence of cybersecurity incidents (Walton et al., 2021). It is not surprising that stakeholders will seek information on how the companies are protecting themselves from cybersecurity incidents (Knechel, 2021). Investors in general and non-professional investors in particular rely on cybersecurity disclosures to take their investment decisions.

Because the assurance on cybersecurity risk management program is of great importance to company's stakeholders in general and investors in particular, the American Institute of Certified Public Accountants (AICPA) issued a risk report-

ing framework to increase the stakeholders' confidence in the company's capability to manage its cybersecurity risks. According to this framework, the company may issue a report that includes management description of the risk management program, management assertion about the description, the cybersecurity controls and their effectiveness to achieve the cybersecurity objectives, and the CPA's opinion on the description and controls effectiveness (AICPA, 2017). The assurance on cybersecurity risk management program can be offered by an auditor (Big4 or non-Big4) or any other assurers. Meanwhile, the level of assurance provided may be limited (moderate assurance level) or reasonable (high assurance level).

The objective of this research is to investigate the impact of assurance quality (measured by the size of the audit firm that performs this assurance; Big4 vs non-Big4) and the level of assurance conveyed in assurance report (reasonable assurance vs. limited assurance) on the cybersecurity risk management program on non-professional investors' decisions; willingness to invest and stock valuation.

The importance of this research stems from the importance of the topic being examined, which is the assurance on cybersecurity risk management program, especially with the increased companies' reliance on information technology to conduct their daily operations.

This study provides several contributions. *First*, this study adds to the cybersecurity literature by investigating the impact of assurance quality and level conveyed in the assurance report on cybersecurity risk management reporting on investors' willingness to invest and their stock valuation. Although prior studies investigated the impact of assurance on cybersecurity risk management reporting on investors' perceptions and investment attractiveness, however this study is different, as it focuses on investors' perception of assurance quality (through the size of the audit firm performing this assurance) and the level of assurance shown in the assurance report. Prior research mainly investigated cybersecurity incidents and attacks and whether the provision of such assurance (separate or joint) or the timing of cyberattack disclosure will affect the investment decisions. *Second*, this

study adds to the research stream on non-audit services, by providing evidence regarding the value of assurance on cybersecurity risk management reporting and how they are perceived by non-professional investors in Egypt. *Third*, this study helps in understanding non-professional investors' decision making, especially nowadays where nearly all companies are conducting their business on networks and in the cloud and are facing severe security risks that may result in huge financial losses. *Fourth*, this study will help in reducing the accounting research gap related to cybersecurity risk management program, which is consistent with the Egyptian government's efforts and attention paid to cybersecurity and its related risks.

The remainder of the paper will be organized as follows: Section 2 discusses prior literature related to cybersecurity and the importance of assurance on cybersecurity risk management reporting program on investors decisions to develop the research hypotheses. Section 3 describes the research design, variables and their measurements. Section 4 presents the results of the research. Finally, in section 5 the conclusions are summarized and avenues for future research are suggested.

2. Literature Review and Hypotheses Development

2.1 Background on Cybersecurity

In order to understand how the assurance on cybersecurity risk management reporting program is valuable to non-professional investors and how this value might differ when the assurator belongs to one of Big4 audit firms (vs non-Big4 audit firms) and the assurance level is reasonable (vs limited), it is important to start with a basic background on cyber risks and security.

Cybersecurity is often used as a synonym term for information security (No & Vasarhelyi, 2017). According to the definition set by Craigen et al. (2014: 17), "Cybersecurity is the organization and collection of resources, processes, and structures used to protect cyberspace and cyberspace-enabled systems from occurrences that misalign de jure from de facto property rights". It can be noted that cybersecurity involves the required technologies, processes and controls that are designed in order to protect the systems, networks and data from cyber at-

tacks and incidents. The effective cybersecurity program is the one that reduces the risk of cyber attacks and incidents and protects everyone from the misuse or unauthorized use of the related systems, networks and technologies (Haapamäki & Sihvonen, 2019).

Cybersecurity risk is considered to be one of the top risks that companies face (Al-Moshaigeh et al., 2019). Cyberattacks are costly and may have a severe impact on the company's financial position and may cause a material misstatement in the company's records (Brazina et al., 2019), that's why risks related to cybersecurity are of great importance to investors during the investment decision making process. Based on a recent survey by the Center of Audit Quality in 2017, 43% of non-professional investors in the U.S. viewed cybersecurity as important to them to a great extent and the related incidents will affect their investment plans (Center of Audit Quality, 2017).

Due to the importance of cybersecurity attacks and investors' view of cybersecurity as one of the greatest threats of a company's strategic success (Kelton, 2021), investors are more concerned, and managers are now devoting more resources to their cybersecurity risk management program and related disclosures (Eaton et al., 2019). In addition, because the threat of breach can't be avoided, some investors are concerned with the risk management strategy adopted by companies and how the companies are detecting and mitigating the cybersecurity incidents, others are requesting independent assessment of the company's cybersecurity program (EY, 2020).

From the company's point of view, cybersecurity is of great concern. Internally, IT expertise is becoming a necessary characteristic of board members in order to perform their IT and cybersecurity oversight responsibilities (Hartmann and Carmenate, 2021). Firms are seeking directors with IT and cybersecurity expertise in order to create cyber defense strategies that will allow the firms to manage cybersecurity incidents and breaches and adapt to technological disruptions (EY, 2020). Externally, it is important that investors are informed about the material cybersecurity risks and attacks that affect the companies in which they are investing (EY, 2020).

Based on the discussion above, it is clear that cybersecurity risk is one of the most important risks that a company might face and may have severe and negative impact on the company's financial records in case the company didn't detect or mitigate cyber incidents. In addition, how managers manage such risks and report their efforts and how effective are their controls are of great importance to the company's stakeholders in general and its investors in particular.

2.2 Importance of Assurance on Cybersecurity Risk Management Program

Assurance services are defined as “independent professional services that improve the quality of information, for decision makers” (Arens et al., 2017: 8). This definition is broad and includes both auditing and attestation services (Elliott and Pallais, 1997). Assurance is considered a control and monitoring mechanism that improves the perceived credibility of the disclosed information and facilitates greater user confidence (Simnett et al., 2009)

As for an assurance engagement, it is defined by the International Accounting and Auditing Standard Board (2003: 7) as “an engagement in which a practitioner expresses a conclusion designed to enhance the degree of confidence of the intended users other than the responsible party about the outcome of the evaluation or measurement of a subject matter against criteria”. An assurance engagement involves a relationship between three parties; the practitioner, the responsible party, and the intended users, an appropriate subject matter, appropriate criteria that are used as benchmarks to measure or evaluate the subject matter, sufficient evidence and finally a written assurance report in the form appropriate to a reasonable assurance engagement or a limited assurance engagement (IAASB, 2003).

Meanwhile, stakeholders are interested in assured financial and non-financial information in order to take their different decisions (Simnett et al., 2009). Vera-Muñoz, Gaynor and Kinney (2020) stressed the importance of independent assurance reports, as the purpose of such reports is to add value to third party users and increase their confidence that management preparation of financial and non-financial information is free from material misstatements.

Assurance on cybersecurity is beneficial to investors, audit committees and other stakeholders (Fornelli, 2016). In order to enhance the confidence in the company's ability to manage its cyber risks, the American Institute of Certified Public Accountants (AICPA) developed a risk reporting framework (AICPA, 2017). The cybersecurity reporting framework consists of three parts; description of the entity to the risk management program, management's assertion on the entity's description and the effectiveness of the related controls and finally, the practitioner's report on the entity's description and the effectiveness of cybersecurity controls to achieve the objectives of cybersecurity (Banham, 2017).

Issuing this risk reporting framework has several benefits. First, it enables the company to adopt proactive approach to risk management and report those activities to stakeholders (California Society for Certified Public Accountants, 2017). Second, it enables the auditors to expand their services and help the company in managing and understanding cybersecurity risks and achieving their business objectives (Banham, 2017). In addition, it gives the company the option to rely on the CPA's expertise in auditing controls in order to obtain an assurance report on the management's description and assessment of the effectiveness of related controls. Trust services criteria provided by AICPA in 2017 may be used to support the cybersecurity reporting framework and the managers' and auditors in fulfilling their roles (Banham, 2017).

As the risk reporting framework issued by the AICPA is voluntary, companies may choose whether to include the management assertion only or accompany it with third party assurance (Frank et al., 2019) and whether this assurance is to be offered by auditors (Big4 or non-big4) or other assurors and whether the assurance level is limited or reasonable.

Based on the discussion above, it is clear that assurance on cybersecurity is beneficial to internal and external stakeholders, as it adds value to the management reporting on its cybersecurity program. Because of its importance, the AICPA issued a risk reporting framework to help managers in their management of related risk and guide auditors in their assurance engagement.

2.3 Impact of Cybersecurity Risk Management Disclosure and the Related Assurance on Investors' Perception and Decisions

According to the signaling theory, which focuses on reducing the information asymmetry between managers and stakeholder, managers may use their disclosure on cybersecurity risk program and the assurance on this program and its controls to send message to outside stakeholders that they are having effective cybersecurity controls in place (Kelton & Pennington, 2020) and they are exerting efforts to protect their companies from cyberattacks.

Meanwhile, companies should provide their investors and the market with prompt information regarding any real risks that affect their business (Newman, 2018). In order to maintain an effective risk management program, five stages should be adopted, which are 1) identification and prioritization of cybersecurity risk and exposure, 2) design of cybersecurity control system, 3) testing the operating effectiveness of the cybersecurity controls, 4) external reporting of cybersecurity, and 5) providing assurance on the external cybersecurity reporting, where accounting firms can provide a formal professional and independent assurance on the effectiveness of risk management program.

It is important to note that cybersecurity risk disclosure is a double edge sword, as it acts as a critical link between managers and external stakeholders and may help in reducing the level of information asymmetry (Jiang et al., 2021), and at the same time, disclosing risks related to cybersecurity may attract hackers to the firm's information systems and increase the probability of future cybersecurity incidents (Walton et al., 2021)

Prior studies investigated the impact of cybersecurity on different investment aspects. Based on a sample of 9,677 firm year observations from 2,264 firms in US, Berkman et al. (2018) tested the impact of cybersecurity awareness, measured by the disclosure of information security, on the market value and found a positive and significant relationship. In the same context, Cheng & Walton (2019) investigated the impact of data breach disclosure initiative and timing on investors' valuations. Based on a sample of 107 non-professional investors from

32 states in US, the authors found that investors' valuation was negative in case the company is the first one to disclose the data breach and when there is a significant delay between the time of data breach and the time of public disclosure.

Consistently, Frank et al. (2019) investigated the impact of voluntary third-party assurance on cybersecurity risk management reporting program on investment attractiveness. The authors hypothesized that including the management assertion only will be more effective in case the company didn't experience cyberattack because non-professional investors won't question the reliability of the management. Also, the authors hypothesized that in case the company experience cyberattack, the third-party assurance will enhance the company's investment attractiveness. In general offering third party assurance on cybersecurity risk management reporting will have a positive impact on investment attractiveness of the company, as it increases the reliability of management component from the investors' point of view. Based on a sample of 547 non-professional investors from Amazon's Mechanical Turk, the authors confirmed their hypotheses.

In addition, Yang et al. (2020) developed a research model of investors' perception of the cybersecurity risk management reporting framework. They hypothesized that information quality and cybersecurity awareness will have a positive impact on the perceived benefits of the risk management program and that trust mediates this relationship and that the investors' perceived benefits will have a positive impact on their intention to invest. Based on a sample of 226 non-professional investors in US, the authors found evidence that confirmed their expectations.

In the same context, Perols & Murthy (2021) investigated the impact of separate vs joint provision of assurance service on cybersecurity risk management on the investors' perception and decisions and whether this impact will differ in case there is a subsequent cybercrime. Based on a sample of 106 MBA students at a major public university in U.S., the authors found that in case the subsequent cybersecurity incident is absent, the provision of cybersecurity assurance and auditing services to the same company (joint provision of cybersecurity assurance) will increase the auditor competence from the investors' point of view, however

it reduces the level of perceived auditor independence. On the other hand, the authors found that in case of subsequent cybersecurity incident, the negative impact on auditor independence outweighs the positive impact on auditor competence from the investors' point of view.

Based on the discussion above, it is obvious that assurance on cybersecurity is valuable from the investors' point of view. This assurance service will help in enhancing the level of transparency and reducing the level of information asymmetry between managers and the stakeholders in general and investors in particular. Prior research investigated the impact of assurance on cybersecurity risk management program on investors' perception and decisions, but most of them concentrated on the case where cyber incidents and crimes occur.

2.3.1 Impact of Assurance Quality on Investors' Decisions

External auditors have played a great role in information security for decades as four out of the main and leading 13 information security and cybersecurity consultants are public accounting firms. Also, external auditors can bring their core competencies, in the form of skepticism, independence, expertise and objectivity to provide independent assurance on financial and non-financial information (Center for Audit Quality, 2018)

It should be noted that accounting firms, in general, have the required competencies and expertise in the area of assurance, and they are expert in evaluating the effectiveness of cybersecurity risk management. They can bring their knowledge in internal controls, external reporting and assurance to evaluate the effectiveness of cybersecurity risk management (Eaton et al., 2019). Also, objectivity and expertise are the most important attributes in selecting an assurance service provider and accountants are considered to be the most preferred service provider for assurance over information systems (Knechel et al., 2006).

According to source credibility theory, the information provided from less credibility sources is less persuasive in comparison to that provided from more credibility sources (Pornpitakpan, 2004). Järvinen et al. (2018) investigated the impact of going concern opinion and the signing of the audit report by a Big4

audit firm (as a measure of credibility) on the loan officers' decisions in granting loans to financially distressed firms. Based on a sample of 35 loan officers, the authors found that the audit report that includes a going concern paragraph and signed by one of the Big4 auditor is more persuasive and credible than the clean audit report signed by one of the non-big4 auditor. So, it is proven that the credibility of the audit report is affected by the credibility of the auditor who signed the audit report.

Additionally, Big4 auditors are known for their high independence and expertise in non-financial assurance (Mock et al., 2007) and high internal quality standards, in addition they are known for their deep pockets and not customer dependent. On the contrary, small audit firms are relying to a great extent on the customers' revenues. They have greater capacity to invest in new technologies and they have a greater investment to maintain their reputational capital (Simnett et al., 2009). In addition, it is important to note that the assurance on cybersecurity program requires specialized skills and many firms which don't have these skills won't be able to offer these services (Banham, 2017).

Based on the foregoing and in accordance with the signaling theory, managers may select a Big4 audit firm to assure on its cybersecurity risk management program to signal their commitment (Clarkson et al., 2019). Consequently, it is expected that the assurance on cybersecurity risk management reporting will have a significant positive impact on investors' willingness to invest and their stock valuation when such assurance is provided by a Big4 auditor than in case it is offered by a non-big4 auditor. Accordingly, the first and second research hypotheses can be formulated as follows:

H1: investors' willingness to invest will increase significantly in case a Big4 auditor provides an assurance on the cybersecurity risk management program compared to a non-big4 auditor

H2: investors' stock valuation will be more favorable in case a Big4 auditor provides an assurance on the cybersecurity risk management program compared to a non-big4 auditor

2.3.2 Impact of Assurance Level on Investors' Decisions

Assurors are expected to issue an independent assurance report at the end of their limited or reasonable assurance engagement. This assurance report may convey limited or reasonable assurance regarding the effectiveness of controls on cybersecurity risk management program. According to the revised version of ISAE 3000 “Assurance Engagements other than Audits or Reviews of Historical Financial Information”, the assurator reduces the engagement risk in both the reasonable and limited assurance engagements to an acceptable low level as a basis for his/her opinion or conclusion, but the engagement risk in the limited assurance engagement is higher than that in the reasonable assurance engagement. Consistently, the procedures performed in the limited assurance report are lower in comparison to that of reasonable assurance engagement (IAASB, 2013). Also, the number of tests and evidence collected in the limited assurance engagement is fewer than that in the reasonable assurance engagement and concentrate mainly on management inquiry and analytical procedures (www.icaew.com). Finally, in the reasonable assurance engagement, the assurator expresses his/her opinion in a positive form and in the limited assurance engagement, the assurator expresses his conclusion in a negative form which is proportionate to his evidence gathering procedures.

Prior research investigated the impact of assurance level on investment decisions. For instance, Vera-Muñoz et al. (2020) investigated the impact of reasonable vs. limited assurance on Greenhouse Gas (GHG) emissions on report users' confidence judgements. Based on a sample of 210 undergraduate accounting students and 173 MBA students, the authors found that reasonable assurance enhance the users' confidence in the GHG emissions assurance report in comparison to limited assurance.

Applying on integrated reports, Gerwanski et al. (2021) examined the impact of assurance level on investors' decisions. Based on a sample of 142 master students in three German universities and 82 managers, the authors found evidence that reasonable assurance is having a positive and significant effect on investment decisions taken by non-professional investors.

Consistently, Hoang & Trotman (2021) investigated the impact of three assurance levels (no assurance, limited and reasonable assurance) on CSR reports on investors' estimation of fundamental value. Based on a sample of 174 post-graduate students in the Australian Business School, the authors found that reasonable assurance has a positive and significant effect on investors' fundamental value estimates in comparison to the limited assurance case, which in turn has a positive impact on their estimation in comparison to the no assurance case.

Based on the discussion above, it is expected that in order for the assessor to offer reasonable assurance report and expresses his/her opinion will exert more efforts and will gather more evidence and apply different testing procedures, more than what is required in the case of limited assurance engagements. Higher assurance level will involve deeper assurance and will lower the level of information asymmetry (Cuadrado-Ballesteros et al., 2017) and agency costs, and this will result in positive impact on investors decisions. Because limited assurance level involves lower level of comfort, it is expected that the assurance on cybersecurity risk management reporting will have a significant positive impact on investors' willingness to invest and their stock valuation when such assurance is reasonable than in case it is limited. Accordingly, the third and fourth research hypotheses can be formulated as follows:

H3: investors' willingness to invest will increase significantly in case assurance on cybersecurity risk management program is reasonable compared to limited

H4: investors' stock valuation will be more favorable in case assurance on cybersecurity risk management program is reasonable compared to limited.

2.3.3 Interactive Effect of Assurance Quality and Level on Investors' Decisions

Prior studies investigated the interaction between assurance level and provider on different aspects. For instance, Quick and Sayar (2021) examined the impact of assurance on compliance management systems and the interaction effect of assurance provider (audit firms vs. third party assessor) and the assurance level (reasonable vs. limited) on bank directors' credit granting and investment deci-

sions and their advice to non-professional investors to buy shares. Based on a sample of 105 bank directors, the authors didn't find significant effect of the interaction between assurance provider and level on their credit granting decision and their advice to non-professional investors to buy shares. However, the authors found that the impact of the assurance provider on the bank directors' investment decision depends on the level of assurance provided. When the assurance level is reasonable, assurance provider will have a significant positive effect on the bank directors' investment decision, however this is not the case when the assurance level is limited.

In the same context, Gauch & Quick (2021) investigated the impact of assurance on risk management system and the effect of related assurance level (reasonable vs. limited) and assurance provider (accounting firms vs third party assuro) on bank directors' reliance on the system and their investment decisions. Based on a sample of 145 German bank directors, the authors didn't find significant effect of the interaction between assurance provider and level.

If it is expected that higher assurance quality (where the assuro is one of the Big4 audit firms) and higher assurance level (reasonable) will have a significant positive impact on investors' judgements and their willingness to invest, what will be the situation in case the assurance quality is low (offered by a non-Big4) but at the same time the assurance level is high (reasonable) in comparison with the case that the assurance quality is high (offered by a Big4) but in the same time the level of assurance is moderate (limited)? Which variable will be more important and influential from the investors' point of view? Here, there are different possible situation. The first one, is that investors are significantly affected by the level of assurance quality more than the assurance level. In this case, the investors will respond favorably in case the assurance is offered by a Big4 auditor (even if the assurance level is limited) in comparison with the case that the assurance is offered by a non-Big4. The second one, is that investors appreciate the higher assurance level (reasonable) more than the assurance quality variable. In this case, the investors will respond favorably in case the assurance level is reasonable (even if it is offered by a non-Big4) in comparison with the case that the as-

insurance level is limited. The third case is that the net effect of both variables will not differ significantly. Accordingly, the fifth and sixth research hypotheses can be formulated in their alternate form as follows:

H5: investors' willingness to invest will differ significantly in case assurance on cybersecurity risk management program is reasonable and offered by a non-big4 auditor compared to limited and offered by a Big4 auditor

H6: investors' stock valuation will differ significantly in case assurance on cybersecurity risk management program is reasonable and offered by a non-big4 auditor compared to limited and offered by a Big4 auditor

3. Research Method

3.1 Participants

The initial participants pool consists of 80 MBA and postgraduate students from the Faculty of Commerce, Alexandria University and ESLSCA as a proxy for non-professional investors (Elliott, 2006; Tan et al., 2015; Vera-Muñoz et al., 2020, Hoang & Trotman, 2021). After excluding the participants who failed to answer the first manipulation check question (1 participant) and the second manipulation check question (15 question), the final number of participants is 64 (See Figure 1), distributed as follows: Group 1 (Big4 X Reasonable) = 17, Group 2 (non-Big4 X Reasonable) = 16, Group 3 (Big4 X Limited) = 16, and Group 4 (non-Big4 X Limited) = 15 participants (Hodge et al., 2009; Perols & Murthy, 2021). The researcher selected non-professional investors, as a stakeholder group, because they represent a considerable portion of the stock market (Cheng & Walton, 2019)

3.2 Experimental Task and Design

To test the research hypotheses and investigate the impact of assurance quality and level on non-professional investors' decisions, a 2 (Big4 vs non-Big4) X 2 (Reasonable vs. Limited) between-subjects experiment was designed. The researcher chose the experimental laboratory, as although it doesn't capture everything in the real world, but it allows the manipulation of the independent varia-

bles (assurance quality and level) while holding other variables constant and this results in higher internal validity (Wojahn et al., 2015).

Participants were presented with a general background on a hypothetical company, working in the retail industry (See Appendix – Part 1). The researcher selected the retail industry, as the companies working in such sector are concerned with their data protection and secrecy as they adopt electronic commerce. Companies working in e-commerce and retail industry posed the greatest risk (Romanosky, 2016) and are threatened as they hold a vast amount of personal and financial data.

The hypothetical company is assumed to have a wide network in North Africa and Europe, and it entered into a joint venture with a company in China. The participants are presented with positive performance information on the company, showing that its revenues and income have increased during 2020 in comparison with 2019 in comparison with last year. Participants were told that given their limited information on the hypothetical company, they will assume that their willingness to invest and their stock valuation of the company will be on average.

After that the participants were presented with information on the company's cybersecurity risks that it may face and accordingly, the company designed and implemented an enterprise risk management in order to assess the risks that they may face and the controls that will mitigate the impact of these risks on the company's fulfillment of its objectives. Accordingly, the management of the company will issue a cybersecurity risk management program report asserting that the description of the program is in accordance with the description criteria and that they have made an effective evaluation of the controls within the cybersecurity risk management program and that these controls were effective during the period under examination.

After that, the company hired an assurator to examine the cybersecurity risk management program and provide an assurance report on the effectiveness of this program to achieve the entity's cybersecurity objectives. Participants were assigned randomly to 4 experimental cases: case (1) involves a reasonable inde-

pendent assurance report issued by a Big4 audit firm, case (2) involves a reasonable independent assurance report issued by a non-big4 audit firm, case (3) involves a limited independent assurance report issued by a Big4 audit firm, and case (4) involves a limited assurance report issued by a non-big4 audit firm on cybersecurity risk management program (See Appendix – Part 2).

It was expected that investors' willingness to invest and stock valuation will increase significantly in case the assurator is a Big4 audit firm compared to non-big4 audit firm and in case the level of assurance conveyed in the assurance report is reasonable compared to limited.

However, more investigation will be needed to examine the effect of limited assurance offered by a Big4 audit firm, compared to reasonable assurance offered by a non-big4 audit firm. In other words, it is expected to reach one of the following results:

- 1- Investors appreciate the level of reasonable assurance, whether it is offered by a Big4 or a non-big4 audit firm. In this case, the reasonable assurance offered by a non-big4 audit firm will have a significant positive impact on investors' decisions in comparison with limited assurance offered by a Big4 audit firm.
- 2- Investors appreciate a higher level of assurance quality (Big4 audit firm), whether it offers a reasonable or limited assurance report. In this case, the limited assurance offered by a big4 audit firm will have a significant positive impact on investors' decisions in comparison with reasonable assurance offered by a non-Big4 audit firm.
- 3- Investors respond equally to a limited assurance report issued by a Big4 audit firm (investors' decision will be affected negatively by the limited assurance level conveyed in the assurance report) and to a reasonable assurance report issued by a non-big4 audit firm (investors' decision will be affected positively by the reasonable assurance level conveyed in the assurance report).

Assurance level \ Assurance quality	Assurance quality	
Reasonable	Group 1 (n = 17)	Group 2 (n = 16)
Limited	Group 3 (n = 16)	Group 4 (n = 15)

Figure 1: Experimental Groups

3.3 Independent variables

This research involved two independent variables, which are the quality of assurance on cybersecurity risk management program (measured by the size of the assessor; Big4 vs non-Big4) and the assurance level (Reasonable vs Limited) on this program.

The **assurance quality** is measured by the audit firm size offering the assurance on cybersecurity risk management program. It is assumed that Big4 audit firms are known for their high-quality assurance services, and they can reach international standards. The assurance quality is manipulated by having different assessors providing the assurance on cybersecurity risk management program, **Big4** (KPMG – Hazem Hassan) for higher assurance quality level (Cuadrado-Ballesteros et al., 2017) and **non-Big4** (Osama Ahmed) for lower quality level.

The **assurance level** is measured by the level of assurance offered in the assurance report. The assurance level may be reasonable (positive and high level) or limited (negative and moderate one). The assurance level is manipulated by presenting either a reasonable assurance report or a limited assurance report to the participants.

The reasonable assurance report involved some statements to indicate the assurance level such as: “Our responsibility is to express an opinion, based on our examination, about whether the controls within that program were effective to achieve the entity’s cybersecurity objectives based on the control criteria”. “Our examination was conducted in accordance ...”. “An examination provides more evidence than that required in a review, thus the level of assurance is more than that given in a review”. “We believe that the evidence we obtained is sufficient

and appropriate to provide a reasonable basis for our opinion”. “In our opinion, in all material respects, the controls within that program were effective”.

The limited assurance report includes some statements to indicate the lower level of assurance, such as “Our responsibility is to express a conclusion, based on our review, about whether anything has come to our attention that would indicate that the controls within that program were not effective to achieve the entity’s cybersecurity objectives based on the control criteria.”. “Our review was conducted in accordance”. “A review is not designed to detect all weaknesses in control procedures as it is not performed continuously throughout the period and tests performed are on a sample basis. A review also does not provide all the evidence that would be required in an examination; thus, the level of assurance is less than given in an examination. We have not performed an examination and, accordingly, we do not express an opinion based on an examination”. “Based on our review, nothing has come to our attention

3.4 Dependent variables

This research involved two dependent variables, which are willingness to invest and stock valuation. As for the **willingness to invest**, it is assessed using participants’ responses to the question “Based on the disclosures provided to you from ABCD Co. to what extent are you willing to invest in ABCD Co., ranging from low of 0% to high of 100%.”. Concerning **stock valuation**, it is measured based on participants’ responses to the following question “Now that you have more information about the company, please indicate what you believe to be an appropriate common stock valuation for ABCD Co., ranging from low to high”, where the scale ranges from 0 (very low) to 100 (very high).

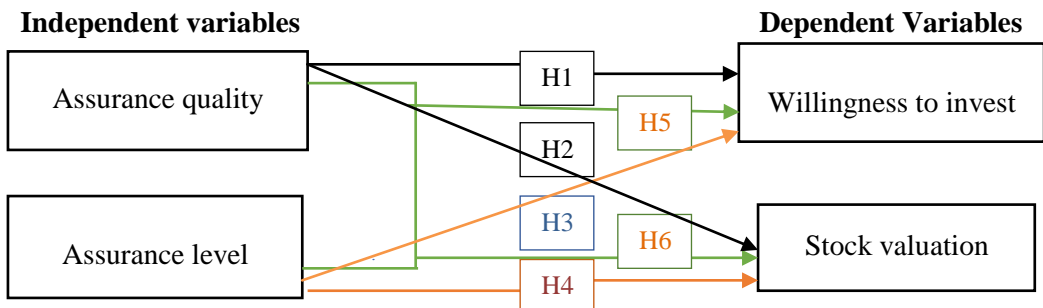


Figure 2: Research Model

4. Results

In this section, the researcher will present the descriptive statistics and statistical results related to reliability and validity of data and hypotheses testing. In addition, the researcher will present some additional testing results.

4.1 Manipulation and Attention check Questions

Two manipulation check questions were used to ensure that the manipulations were effective, and the participants have understood the case presented to them. The first question was related to the size of the auditor, as a proxy for the quality of the assurance service provided on cybersecurity risk management program and the second one was related to the level of assurance on cybersecurity risk management program.

4.2 Descriptive Statistics

The researcher relied on 64 responses from MBA and postgraduate students. According to table (1) panel (A), it is clear that participants' age ranges from 23 to 54 years with an average of 36 years. Participants' years of experience ranges from 1 year to 31 years with an average 13 years. On average, participants completed 15 accounting courses and 3 finance courses.

From Table (1) panel (B), it is obvious that 27 participants (42.2%) were female, and 37 participants (57.8%) were male. Most of the participants (82.8%) didn't have prior experience in stock investment, however two thirds of the participants (68.8%) are planning to invest in the future.

As depicted in Table (1) panel (C), for the high assurance quality sample, the mean of investment opportunity (66.3636), recommendation to friends (3.9697), willingness to invest (68.7879), stock valuation (66.6667) and stock increase (4.1515) are higher than that in the low assurance quality sample. Also, in the high assurance quality sample, the non-professional investors' reliance on management report (mean = 6.2424) and assurance report (mean = 7.6061) is higher than that in the low assurance quality sample. As for the participants characteristics, it is clear that there are no significant differences between the two samples

with regard to their age, years of experience, accounting and finance courses completed, gender, past experience and their willingness to invest in the future.

Similarly, Table (1) panel (D), showed that for the high assurance level sample, the mean of investment opportunity (70.303), recommendation to friends (3.9091), willingness to invest (70.6061), stock valuation (68.4848) and stock increase (4.0606) are higher than that in the low assurance quality sample. Also, in the high assurance quality sample, the non-professional investors' reliance on management report (mean = 6.3636) and assurance report (mean = 7.5152) is higher than that in the low assurance quality sample. As for the participants characteristics, it is clear that there are no significant differences between the two samples with regard to their age, years of experience, accounting and finance courses completed, gender, past experience and their willingness to invest in the future.

Table 1: Descriptive Statistics

Panel A: Continuous variables

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
Age	36.3065	36.0000	7.53699	23.00	54.00
Experience (years)	13.7377	13.0000	7.52751	1.00	31.00
Number of accounting courses	15.9180	15.0000	12.5901	0.00	50.00
Number of finance courses	3.7869	3.0000	3.01725	0.00	12.00

Panel B: Nominal variables

Variable		Frequency	Percent	Cumulative percent
Gender	Male	37	57.8	57.8
	Female	27	42.2	100.0
		64	100.0	
Past experience	No	53	82.2	82.2
	Yes	11	17.8	100.0
		64	100.0	
Future investment	No	20	31.2	31.2
	Yes	44	68.8	100.0
		64	100.0	

Panel C: Participant related descriptive statistics (according to assurance quality)

Assurance Quality	Big4 n = 33		Non-Big4 n = 31	
	Mean	Std. Deviation	Mean	Std. Deviation
Investment Opportunity	66.3636	15.1695	58.0645	20.72347
Recommendation	3.9697	0.52944	3.3871	0.8437
Willingness to invest	68.7879	14.73889	57.7419	21.08865
Stock valuation	66.6667	20.56494	54.1935	21.5676
Stock increase	4.1515	0.56575	3.6774	0.74776
Management report	6.2424	2.4626	5.4516	2.54085
Assurance report	7.6061	1.7667	6	2.80476
Age	37.1515	7.63676	35.3448	7.43676
Experience (years)	14.4688	7.56044	12.931	7.54004
Accounting courses	16.5	12.22636	15.2759	13.16624
Finance courses	4.4688	3.30185	3.0345	2.514
Gender	0.5455	0.50565	0.6129	0.49514
Past experience	0.1515	0.36411	0.1935	0.40161
Investment in the future	0.7273	0.45227	0.6452	0.48637

Panel D: Participant related descriptive statistics (according to assurance level)

Assurance level	Reasonable n = 33		Limited n = 31	
	Mean	Std. Deviation	Mean	Std. Deviation
Investment Opportunity	70.303	14.02784	53.871	18.91691
Recommendation	3.9091	0.63066	3.4516	0.80989
Willingness to invest	70.6061	14.77739	55.8065	19.79464
Stock valuation	68.4848	16.79308	52.2581	23.62339
Stock increase	4.0606	0.74747	3.7742	0.61696
Management report	6.3636	2.13334	5.3226	2.79746
Assurance report	7.5152	1.92226	6.0968	2.749
Age	36.5938	8.22608	36	6.85314
Experience (years)	12.9677	8.12602	14.5333	6.90194
Accounting courses	13.9333	13.42394	17.8387	11.6221
Finance courses	3.6333	3.39861	3.9355	2.64494
Gender	0.697	0.46669	0.4516	0.50588
Past experience	0.1212	0.33143	0.2258	0.42502
Investment in the future	0.7273	0.45227	0.6452	0.48637

To test the reliability of responses, the researcher relied on Cronbach's alpha test. As shown in table (2), Cronbach's alpha value for the two main questions related to willingness to invest and stock valuation is 86.9%. Also, for all ques-

tions, the Cronbach's alpha value is 77.5%, which is quite good in social sciences research (Smith, 2003).

Table 2: Reliability test

	Cronbach's alpha	No. of items	Number of cases
All sample (2 main questions)	86.9%	2	64
All sample (all questions)	77.5%	7	64
Group 1 (Big4 X Reasonable)	76.5%	7	17
Group 2 (Non-Big4 X Reasonable)	70.0%	7	16
Group 3 (Big4 X Limited)	71.2%	7	16
Group 4 (Non-Big4 X Limited)	79.6%	7	15

To test the adequacy of the sample used and the discriminant validity, the researcher made a principal component analysis (shown below in table 3) and it showed that KMO measure of sampling adequacy is 85% (Sig. = 0.000) and that all questions are focusing on one variable which is the investment decision.

Table 3: Sampling adequacy and Factor analysis

Panel A: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.850
Bartlett's Test of Sphericity	Approx. Chi-Square	304.197
	Df	21
	Sig.	0.000

Panel B: Component matrix

	1
Investment Opportunity	0.891
Willingness to invest	0.891
Recommendation	0.812
Stock increase	0.558
Stock valuation	0.887
Management report	0.675
Assurance report	0.830

4.3 Preliminary analysis

The researcher in this section made a preliminary analysis to examine the added value of assurance report on cybersecurity risk management program in general from the investors' point of view. Before presenting the participants with the case information, they were asked to assume that their willingness to invest and stock valuation were set on average (50). The researcher compared the partici-

pants' willingness to invest and stock valuation after presenting the case information with that before giving them the related information (50). The researcher relied on non-parametric statistical tests to run the preliminary and main analyses because the independent variables are nominal and not scale, the dependent variable (willingness to invest) is ordinal and not scale and Kolmogorov Smirnov test showed that the responses on the related questions are not normally distributed (Sig. = 0.000).

4.3.1 Added value of assurance on willingness to invest and stock valuation

To examine the effect of assurance report on investors' willingness to invest and stock valuation, the researcher told the participants to assume that their willingness to invest in ABCD Co. and their stock valuation is set on average (50), in order to note whether there is significant difference in their willingness to invest and stock valuation after presenting them with information on the auditors' assurance on cybersecurity risk management program.

To investigate the impact of assurance on investors' willingness to invest and stock valuation, the researcher relied on Wilcoxon Signed Ranks test to test whether there are significant differences between investors' willingness to invest and stock valuation in case there is no assurance and in case there is assurance on cybersecurity risk management program. In general, tables (4) and (5) show that assurance on cybersecurity risk management program has a significant effect on investors' willingness to invest ($z = -4.617$, Sig. = 0.000) and their stock valuation ($z = -3.407$, Sig. = 0.001). This result is consistent with prior research (Frank et al., 2019; Gerwanski et al., 2021; Hoang & Trotman, 2021) which emphasized the added value of independent assurance report and its positive impact on investment attractiveness and decisions.

Table 4: Effect of Assurance on cybersecurity risk management report on willingness to invest

Panel A: Ranks				
		N	Mean Rank	Sum of Ranks
Willingness to invest – No assurance	Negative Ranks	7 ^a	27.36	191.50
	Positive Ranks	45 ^b	26.37	1186.50
	Ties	12 ^c		
	Total	64		
a. Willingness to invest < No assurance				
b. Willingness to invest > No assurance				
c. Willingness to invest = No assurance				
Panel B: Test Statistics^a				
	Willingness to invest – No assurance			
Z	- 4.617 ^b			
Asymp. Sig. (2-tailed)	0.000			
a Wilcoxon Signed Ranks Test				
b Based on negative ranks.				

Table 5: Effect of Assurance on cybersecurity risk management report on Stock valuation

Panel A: Ranks				
		N	Mean Rank	Sum of Ranks
Stock valuation – No assurance	Negative Ranks	14 ^a	31.29	438.00
	Positive Ranks	45 ^b	29.60	1332.00
	Ties	5 ^c		
	Total	64		
a. Stock valuation < No assurance				
b. Stock valuation > No assurance				
c. Stock valuation = No assurance				
Panel B: Test Statistics^a				
	Stock valuation – No assurance			
Z	- 3.407 ^b			
Asymp. Sig. (2-tailed)	0.001			
a Wilcoxon Signed Ranks Test				
b Based on negative ranks.				
b Based on negative ranks.				

4.4 Hypotheses Testing

4.4.1 Testing H1

To test the first research hypothesis (H1), which states that “investors’ willingness to invest will increase significantly in case a Big4 auditor provides an assurance on the cybersecurity risk management program compared to a non-big4 auditor”, the researcher split the full sample according to assurance quality (Big4 and non-Big4) and used Mann Whitney non-parametric test to compare the responses of group 1 (Big4 X Reasonable) and group 3 (Big4 X Limited) on the willingness to invest question with that of group 2 (non-Big4 X Reasonable) and 4 (non-Big4 X Limited).

To provide support for the results, the researcher added other questions that are expected to be related to the investors’ willingness to invest. These questions are related to the investors’ view of the company as a good investment opportunity and their recommendation to their friends. The researcher compared the participants’ responses on the investment opportunity and the recommendation to friends’ questions, as it is expected that if the respondent viewed the firm as a good investment opportunity, he/she will be willing to invest in the company stock and will recommend it to his/her friends.

It is clear from table (6) that assurance quality is positively signed and has a significant impact on the non-professional investors’ willingness to invest. Thus, the result indicates that investors’ confidence in the management efforts regarding cybersecurity risks will increase in case the assurator is one of the Big4 audit firms, be willing to invest in the company stock (Mean rank = 36.97, $z = -2.43$, Sig. = 0.041) and will recommend it to their friends (Mean rank = 37.83, $z = -2.843$, Sig. = 0.004) than in case this assurator is a non-Big4 auditor.

This result is consistent with the source credibility theory, which emphasized that the credibility of the information is affected by the credibility of the source of this information and with the signaling theory which shows that firm’s choice of assurance providers from the Big4 audit firms may be used to signal their commitment related to non-financial disclosures.

Additionally, this result is consistent with prior literature (Mock et al., 2007; Clarkson et al., 2019) which concluded that Big4 audit firms are known for their expertise and higher non-financial assurance quality services and their assurance will be valued by the market.

On the other side, this result is not consistent with the findings of (Shen et al., 2017; Gerwanski et al., 2021), which didn't find evidence that the choice of assurance provider will affect the investment decisions made by non-professional investors. However, consistent with expectations, this result emphasized the enhanced audit quality and assurance services offered by Big4 audit firms, as Big4 audit firms are known for their good reputation, access to international standards, expertise in non-financial assurance and ability to attract good competencies and experts. Based on this, investors will have more confidence in the company's cybersecurity risk management program when it is assured by a Big4 audit firm and their willingness to invest in the company stock will increase significantly. **Accordingly, the first research hypothesis (H1) is supported.**

**Table 6: Mann Whitney Test Results
(Impact of assurance quality on willingness to invest)**

Panel A: Ranks				
Assurance Quality		N	Mean Rank	Sum of Ranks
Investment Opportunity	Big4	33	35.59	1174.50
	Non-Big4	31	29.21	905.50
	Total	64		
Willingness to invest	Big4	33	36.97	1220.00
	Non-Big4	31	27.74	860.00
	Total	64		
Recommendation to friends	Big4	33	37.83	1248.50
	Non-Big4	31	26.82	831.50
	Total	64		
Panel B: Test Statistics ^a				
	Investment Opportunity	Willingness to invest	Recommendation to friends	
Mann-Whitney U	409.500	364.000	335.500	
Wilcoxon W	905.500	860.000	831.500	
Z	-1.403	-2.043	-2.843	
Asymp. Sig. (2-tailed)	0.161	0.041	0.004	
a Grouping Variable: Assurance Quality				

4.4.2 Testing H2

To test the second research hypothesis (H2), which states that “investors’ stock valuation will be more favorable in case a Big4 auditor provides an assurance on the cybersecurity risk management program compared to a non-big4 auditor”, the researcher relied on Mann Whitney test to compare the responses of group 1 and group 3 responses on the stock valuation question with that of group 2 and 4. Also, the researcher compared the responses related to the investors’ expectations of stock increase in the coming 12 months.

As shown in table (7), it can be inferred that assurance quality has a positive and significant impact on the investors’ stock valuation and their expectations regarding the company’s stock value. Thus, it can be concluded that when the assessor on cybersecurity risk management program is one of the Big4 audit firms, the investors will value the stocks of the company at a higher level (Mean rank = 37.61, $z = -2.306$, Sig. = 0.021) and will expect that this value will increase during the coming 12 months (Mean rank = 37.48, $z = -2.621$, Sig. = 0.009). Consistent with the findings related to the first research hypothesis, the positive impact of assurance quality on investors’ stock valuation is consistent with the source credibility and signaling theories and with the findings of prior studies (Mock et al., 2007; Clarkson et al., 2019) which emphasized the higher non-financial assurance quality services offered by Big4 auditing firms. Also, this result is in contrast to that of Shen et al., (2017) and that of Gerwanski et al. (2021), who didn’t find significant effect of choosing one of the Big4 audit firms as an assurance provider on the investment decisions made by non-professional investors.

However, consistent with expectations, it can be concluded that when investors’ confidence and willingness increase, their valuation of the company stock will be higher and also their expectations of future of company stock value will be more favorable. **Accordingly, the second research hypothesis (H2) is supported.**

Table 7: Mann Whitney Test Results
(Impact of assurance quality on stock valuation)

Panel A: Ranks				
Assurance Quality		N	Mean Rank	Sum of Ranks
Stock valuation	Big4	33	37.61	1241.00
	Non-Big4	31	27.06	839.00
	Total	64		
Stock Increase	Big4	33	37.48	1237.00
	Non-Big4	31	27.19	843.00
	Total	64		
Panel B: Test Statistics ^a				
	Stock valuation		Stock Increase	
Mann-Whitney U	343.000		347.000	
Wilcoxon W	839.000		843.000	
Z	-2.306		-2.621	
Asymp. Sig. (2-tailed)	0.021		0.009	
a Grouping Variable: Assurance Quality				

4.4.3 Testing H3

To test the third research hypothesis (H3), which states that “investors’ willingness to invest will increase significantly in case assurance on cybersecurity risk management program is reasonable compared to limited”, the researcher relied on Mann Whitney test to compare the participants’ responses in group 1 and group 2 on the willingness to invest question with that of group 3 and 4. To provide support for the results, the researcher compared the responses on the investment opportunity and the recommendation to friends question, as it is expected that if the respondent viewed the firm as a good investment opportunity, he will be willing to invest in this company and will recommend it to his/her friends.

As shown in table (8), the Mann Whitney results showed that investors will view the company as a good investment opportunity (Mean rank = 40.45, $z = -3.610$, Sig. = 0.000) if the assurance level on cybersecurity risk management program is reasonable than in case the assurance level is limited (Mean rank = 24.03). Accordingly, they will be willing to invest in the company stock (Mean rank = 39.77, $z = -3.324$, Sig. = 0.001) and will recommend it to their friends (Mean rank = 37.41, $z = -2.617$, Sig. = 0.009).

The above result is consistent with the findings of prior research (Vera-Muñoz et al., 2020; Gerwanski et al., 2021) which emphasized the positive impact of high and reasonable assurance level offered on nonfinancial disclosures, such as GHG emissions and integrated reports on non-professional investors' decisions. As reasonable assurance is a higher level one and to reach such level of assurance, the assurator should have exerted more efforts (in comparison to that of limited assurance) and collected more evidence. Based on this, investors will show more comfort and confidence in case the assurance level on cybersecurity risk management program is reasonable and high. **Accordingly, the third research hypothesis (H3) is supported.**

**Table 8: Mann Whitney Test Results
(Impact of assurance level on willingness to invest)**

Panel A: Ranks				
Assurance Level		N	Mean Rank	Sum of Ranks
Investment Opportunity	Reasonable	33	40.45	1335.00
	Limited	31	24.03	745.00
	Total	64		
Willingness to invest	Reasonable	33	39.77	1312.50
	Limited	31	24.76	767.50
	Total	64		
Recommendation to friends	Reasonable	33	37.41	1234.50
	Limited	31	27.27	845.50
	Total	64		
Panel B: Test Statistics ^a				
	Investment Opportunity	Willingness to invest	Recommendation to friends	
Mann-Whitney U	249.000	271.500	349.500	
Wilcoxon W	745.000	767.500	845.500	
Z	-3.610	-3.324	-2.617	
Asymp. Sig. (2-tailed)	0.000	0.001	0.009	
a Grouping Variable: Assurance Level				

4.4.4 Testing H4

To test the fourth research hypothesis (H4), which states that “investors’ stock valuation will be more favorable in case assurance on cybersecurity risk management program is reasonable compared to limited”, the researcher relied on Mann Whitney test to compare group 1 and group 2 responses on the stock valuation question with that of group 3 and 4. Also, the researcher compared the responses related to the investors’ expectations of stock increase in the coming 12 months. As clear in table (9), statistical results showed that assurance level has a significant and positive effect on investors’ stock valuation and their expectations related to the value of this stock in the coming 12 months. Investors will value the company’s stock at a higher level (Mean rank = 38.23, $z = -2.586$, Sig. = 0.010) when the assurance provided on the cybersecurity risk management program is reasonable than if it is limited (Mean rank = 26.40). Additionally, investors will expect that the company’s stock value will increase in the coming 12 months (Mean rank = 35.77, $z = -1.721$, Sig. = 0.085) (at 10% significance level) when the assurance provided on the cybersecurity risk management program is reasonable than if it is limited (Mean rank = 29.02).

Consistent with the above result related to hypothesis (3) and confirming the findings of prior studies (Vera-Muñoz et al., 2020; Gerwanski et al., 2021; Hoang & Trotman, 2021), it can be concluded that investors’ confidence in the cybersecurity risk management program will increase, when a reasonable assurance report is issued on such program, and this will be reflected positively on their stock valuation and their expectations regarding the stock increase in the coming 12 months. **Accordingly, the fourth research hypothesis (H4) is supported.**

Table 9: Mann Whitney Test Results
(Impact of assurance level on stock valuation)

Panel A: Ranks				
Assurance Level		N	Mean Rank	Sum of Ranks
Stock valuation	Reasonable	33	38.23	1261.50
	Limited	31	26.40	818.50
	Total	64		
Stock Increase	Reasonable	33	35.77	1180.50
	Limited	31	29.02	899.50
	Total	64		
Panel B: Test Statistics ^a				
	Stock valuation		Stock Increase	
Mann-Whitney U	322.500		403.500	
Wilcoxon W	818.500		899.500	
Z	-2.586		-1.721	
Asymp. Sig. (2-tailed)	0.010		0.085	
a Grouping Variable: Assurance Level				

4.4.5 Testing H5

To test the fifth research hypothesis (H5), which states that “investors’ willingness to invest will differ significantly in case assurance on cybersecurity risk management program is reasonable and offered by a non-Big4 auditor compared to limited and offered by a Big4 auditor”, the researcher compared the participants’ responses to the related questions between group 2 (Non-Big4 X Reasonable) with that of group 3 (Big4 X Limited).

From table (10), it can be inferred that investors’ willingness to invest will not differ significantly in case the assurator is a non-Big4, and the assurance level is reasonable than in case the assurator is one of the Big4 and offering limited assurance on cybersecurity risk management program. The interaction between assurance quality and level doesn’t have significant effect on investment opportunity ($z = -1.478$, Sig. 0.160), willingness to invest ($z = -0.888$, Sig. = 0.402) or recommendation to friends ($z = -0.124$, Sig. = 0.926). This result showed that the positive effect of high assurance quality (Big4) was reduced by the moderate assurance level (Limited) and the positive effect of high assurance level (Reasonable) was reduced by the low assurance quality (non-Big4), leading to insignificant differences between the two cases with respect to investors’ willingness to invest.

This result is consistent with that of Gauch & Quick (2021), which didn't find significant effect of the interaction between assurance level related to risk management system and assurance provider on bank directors' investment decisions. Thus, it can be concluded that the cumulative or interactive effect of high assurance quality and moderate assurance level on investors' willingness to invest is not significantly different than the cumulative effect of low assurance quality and high assurance level. **Accordingly, the fifth research hypothesis (H5) is not supported.**

Table 10: Mann Whitney Test Results

(interactive effect of assurance quality and level on willingness to invest)

Panel A: Ranks				
	Group	N	Mean Rank	Sum of Ranks
Investment Opportunity	2	16	18.88	302.00
	3	16	14.13	226.00
	Total	32		
Willingness to invest	2	16	17.91	286.50
	3	16	15.09	241.50
	Total	32		
Recommendation to friends	2	16	16.34	261.50
	3	16	16.66	266.50
	Total	32		
Panel B: Test Statistics^a				
	Investment Opportunity	Willingness to invest	Recommendation to friends	
Mann-Whitney U	90.000	105.500	125.500	
Wilcoxon W	226.000	241.500	261.500	
Z	-1.478	-0.888	-0.124	
Asymp. Sig. (2-tailed)	0.139	0.375	0.901	
Exact Sig. [2*(1-tailed Sig.)]	0.160 ^b	0.402 ^b	0.926 ^b	
a Grouping Variable: Group				
b Not corrected for ties				

4.4.6 Testing H6

To test the sixth research hypothesis (H6), which states that “investors’ stock valuation will differ significantly in case assurance on cybersecurity risk management program is reasonable and offered by a non-Big4 auditor compared to limited and offered by a Big4 auditor”, the researcher compared the responses of the participants in group 2 (non-Big4 X Reasonable) on the related questions with that of group 3 (Big4 X Limited).

From table (11), it is clear that both assurance level and quality are important from the non-professional investors’ point of view and that investors’ stock valuation will not differ significantly in case the assurator is a non-Big4, and the assurance level is reasonable than in case the assurator is one of the Big4 and offering limited assurance on cybersecurity risk management program. The interactive effect of assurance quality and level doesn’t have significant effect on stock valuation ($z = -0.250$, Sig. 0.809) and their expectations regarding the increase in stock value in the coming 12 months ($z = -0.761$, Sig. = 0.539). Consistent with the previous result related to hypothesis (5) and that of Gauch & Quick (2021) findings, it can be noted that the total or cumulative effect of high assurance quality and moderate assurance level on investors’ stock valuation will not differ significantly than the total effect of low assurance quality and high assurance level. Again, it can be concluded that the positive effect of high assurance quality (Big4) was reduced by the moderate assurance level (Limited) and the positive effect of high assurance level (Reasonable) is reduced by the low assurance quality (non-Big4), leading to insignificant differences between the two cases with respect to investors’ stock valuation. **Accordingly, the sixth research hypothesis (H6) is not supported.**

Table 11: Mann Whitney Test Results
(interactive effect of assurance quality and level on stock valuation)

Panel A: Ranks				
Group		N	Mean Rank	Sum of Ranks
Stock valuation	2	16	16.91	270.50
	3	16	16.09	257.50
	Total	32		
Stock Increase	2	16	15.47	247.50
	3	16	17.53	280.50
	Total	32		
Panel B: Test Statistics^a				
	Stock valuation		Stock Increase	
Mann-Whitney U	121.500		111.500	
Wilcoxon W	257.500		247.500	
Z	-0.250		-0.761	
Asymp. Sig. (2-tailed)	0.803		0.447	
Exact Sig. [2*(1-tailed Sig.)]	0.809 ^b		0.539 ^b	
a Grouping Variable: Group				
b Not corrected for ties				

4.5 Additional Analyses

4.5.1 Added value of assurance on cybersecurity risk management program (Big4 vs. Non-Big4)

As can be noted, the assurance on cybersecurity risk management program is significantly valued by non-professional investors and has positive impact on the investors' willingness to invest and stock valuation, the question here is whether this impact differs according to different assurance quality and level?.

To examine whether the impact of the assurance on cybersecurity risk management program differs according to different assurance quality level, the researcher split the full sample according to the assurance quality to reach two sub-samples: Big4 (n = 33) and non-Big4 (n = 31). The researcher used Wilcoxon Signed Rank test to compare the participants' responses on the willingness to test question with the prior judgement presented to them which is (50).

From table (12), it is found that the assurance on cybersecurity risk management program is highly valued by investors when the assurator is one of the Big4 audit firms (at 1% significance level). Meanwhile, assurance is valued by investors

and affect their willingness to invest when the assurator is a non-Big4 (at 5% significance level).

Concerning the impact of assurance on stock valuation and whether it differs according to the assurator size (assurance quality), the researcher found in table (13) that assurance on cybersecurity risk management program is having a significant effect on non-professional investors' stock valuation when the assurator is one of the Big4 only ($z = -3.516$, Sig. = 0.000), however when the assurator is a non-Big4, results didn't stand ($z = -1.115$, Sig. = 0.265).

Table 12: Effect of Assurance on cybersecurity risk management report on willingness to invest (Big4 Vs. Non-Big4)

Panel A: Ranks					
Assurance Quality			N	Mean Rank	Sum of Ranks
Big4	Willingness to invest – No assurance	Negative Ranks	1 ^a	10.50	10.50
		Positive Ranks	26 ^b	14.13	367.50
		Ties	6 ^c		
		Total	33		
Non-Big4	Willingness to invest – No assurance	Negative Ranks	6 ^a	14.67	88.00
		Positive Ranks	19 ^b	12.47	237.00
		Ties	6 ^c		
		Total	31		
a. Willingness to invest < No assurance					
b. Willingness to invest > No assurance					
c. Willingness to invest = No assurance					
Panel B: Test Statistics^a					
Assurance Quality		Willingness to invest – No assurance			
Big4	Z	- 4.404 ^b			
	Asymp. Sig. (2-tailed)	0.000			
Non-Big4	Z	- 2.030 ^b			
	Asymp. Sig. (2-tailed)	0.042			
a Wilcoxon Signed Ranks Test					
b Based on negative ranks.					

Table 13: Effect of Assurance on cybersecurity risk management report on Stock valuation (Big4 Vs. Non-Big4)

Panel A: Ranks					
Assurance Quality			N	Mean Rank	Sum of Ranks
Big4	Stock valuation – No assurance	Negative Ranks	4 ^a	15.75	63.00
		Positive Ranks	26 ^b	15.46	402.00
		Ties	3 ^c		
		Total	33		
Non-Big4	Stock valuation – No assurance	Negative Ranks	10 ^a	16.65	166.50
		Positive Ranks	19 ^b	14.13	268.50
		Ties	2 ^c		
		Total	31		
a. Stock valuation < No assurance					
b. Stock valuation > No assurance					
c. Stock valuation = No assurance					
Panel B: Test Statistics^a					
Assurance Quality		Stock valuation – No assurance			
Big4	Z	- 3.516 ^b			
	Asymp. Sig. (2-tailed)	0.000			
Non-Big4	Z	- 1.115 ^b			
	Asymp. Sig. (2-tailed)	0.265			
a Wilcoxon Signed Ranks Test					
b Based on negative ranks.					

4.5.2 Added value of assurance on cybersecurity risk management program (Reasonable vs. Limited)

As for the second independent variable, assurance level, the researcher divided the full sample according to the assurance level (Reasonable vs. Limited) and used Wilcoxon Signed Rank Test to compare their responses to the questions related to their willingness to invest and stock valuation with their preliminary judgement which is (50). The researcher found that assurance on cybersecurity risk management program is highly valued from the investors' point of view and has a significant impact on their willingness to invest ($z = -4.496$, Sig. = 0.000)

and stock valuation ($z = -4.262$, Sig. = 0.000) when the assurance level is reasonable than when it is limited (Tables 14 and 15).

Table 14: Effect of Assurance on cybersecurity risk management report on willingness to invest (Reasonable Vs. Limited)

Panel A: Ranks					
Assurance Level			N	Mean Rank	Sum of Ranks
Reasonable	Willingness to invest – No assurance	Negative Ranks	1 ^a	9.00	9.00
		Positive Ranks	27 ^b	14.70	397.00
		Ties	5 ^c		
		Total	33		
Limited	Willingness to invest – No assurance	Negative Ranks	6 ^a	15.08	90.50
		Positive Ranks	18 ^b	11.64	209.50
		Ties	7 ^c		
		Total	31		
a. Willingness to invest < No assurance					
b. Willingness to invest > No assurance					
c. Willingness to invest = No assurance					
Panel B: Test Statistics^a					
Assurance Level		Willingness to invest – No assurance			
Reasonable	Z	- 4.496 ^b			
	Asymp. Sig. (2-tailed)	0.000			
Limited	Z	- 1.744 ^b			
	Asymp. Sig. (2-tailed)	0.081			
a Wilcoxon Signed Ranks Test					
b Based on negative ranks.					

Table 15: Effect of Assurance on cybersecurity risk management report on stock valuation (Reasonable Vs. Limited)

Panel A: Ranks					
Assurance Level			N	Mean Rank	Sum of Ranks
Reasonable	Stock valuation – No assurance	Negative Ranks	3 ^a	11.00	33.00
		Positive Ranks	28 ^b	16.54	463.00
		Ties	2 ^c		
		Total	33		
Limited	Stock valuation – No assurance	Negative Ranks	11 ^a	16.59	182.50
		Positive Ranks	17 ^b	13.15	223.50
		Ties	3 ^c		
		Total	31		
a. Stock valuation < No assurance					
b. Stock valuation > No assurance					
c. Stock valuation = No assurance					
Panel B: Test Statistics^a					
Assurance Level		Stock valuation – No assurance			
Reasonable	Z	- 4.262 ^b			
	Asymp. Sig. (2-tailed)	0.000			
Limited	Z	- 0.471 ^b			
	Asymp. Sig. (2-tailed)	0.637			
a Wilcoxon Signed Ranks Test					

4.5.3 Effect of assurance quality on investors' willingness to invest and stock valuation in case assurance level is reasonable

Comparing Group 1 (Big4 X Reasonable) with Group 2 (Non-Big4 X Reasonable)

To investigate the impact of assurance quality (Big4 vs. non-Big4) in case the level of assurance provided is reasonable, the researcher compared the responses of the participants on the case questions in Group 1 with that in Group 2 using Mann Whitney test. Results show that in case assurance level is high, the size of assurator will not have a significant effect on the investors' willingness to invest ($z = -1.295$, Sig. = 0.217). However, assurance quality will have a significant positive effect on the investors' stock valuation ($z = -2.633$, Sig. = 0.010).

It is clear from table (16) that assurance quality will not affect the investors' view of the company as an investment opportunity ($z = -1.720$, Sig. = 0.102), and this might be because of the small sample size. On the other hand, it is obvious that non-professional investors prefer the reasonable assurance report to be issued by a Big4 auditor, and when it is so, their valuation of the company's stock will be higher, and they will expect an increase in the stock value during the coming 12 months.

Table 16: Mann Whitney Test

(Impact of assurance quality in case assurance level is reasonable)

Panel A: Ranks					
Group		N	Mean Rank	Sum of Ranks	
Investment Opportunity	1	17	19.71	335.00	
	2	16	14.13	226.00	
	Total	33			
Willingness to invest	1	17	19.03	323.50	
	2	16	14.84	237.50	
	Total	33			
Recommendation to friends	1	17	19.24	327.00	
	2	16	14.63	234.00	
	Total	33			
Stock valuation	1	17	21.15	359.50	
	2	16	12.59	201.50	
	Total	33			
Stock Increase	1	17	20.38	346.50	
	2	16	13.41	214.50	
	Total	33			
Panel B: Test Statistics ^a					
	Investment Opportunity	Willingness to invest	Recommendation to friends	Stock valuation	Stock Increase
Mann-Whitney U	90.000	101.500	98.000	65.500	78.500
Wilcoxon W	226.000	237.500	234.000	201.500	214.500
Z	-1.720	-1.295	-1.916	-2.633	-2.295
Asymp. Sig. (2-tailed)	0.085	0.195	0.055	0.008	0.022
Exact Sig. [2*(1-tailed Sig.)]	0.102 ^b	0.217 ^b	0.179 ^b	0.010 ^b	0.037 ^b
a Grouping Variable: Group					
b Not corrected for ties					

4.5.4 Effect of assurance quality on investors' willingness to invest and stock valuation in case assurance level is limited

Comparing Group 3 (Big4 X Limited) with Group 4 (Non- Big4 X Limited)

To investigate the impact of assurance quality (Big4 vs. non-Big4) in case the level of assurance provided is limited, the researcher compared the responses on the case questions between Group 3 (Big4 X Limited) and Group 4 (Non-Big4 X Limited) using Mann Whitney test. The results shown in table (17) revealed no significant effect of assurance quality on non-professional investors' decisions, except that they might recommend the company to their friends in case the reasonable assurance report is issued by one of the Big4 ($z = -2.409$, Sig. = 0.030). the insignificant effect of assurance quality on investment decision is consistent with the result of Quick & Sayar's (2021) study, which didn't find significant effect of the choice of assurance provider on bank directors' credit granting decisions when the assurance level is limited.

**Table 17: Mann Whitney Test
(Impact of assurance quality in case assurance level is limited)**

Panel A: Ranks					
Group		N	Mean Rank	Sum of Ranks	
Investment Opportunity	3	16	16.44	263.00	
	4	15	15.53	233.00	
	Total	31			
Willingness to invest	3	16	18.31	293.00	
	4	15	13.53	203.00	
	Total	31			
Recommendation to friends	3	16	19.44	311.00	
	4	15	12.33	185.00	
	Total	31			
Stock valuation	3	16	17.44	279.00	
	4	15	14.47	217.00	
	Total	31			
Stock Increase	3	16	17.53	280.50	
	4	15	14.37	215.50	
	Total	31			
Panel B: Test Statistics ^a					
	Investment Opportunity	Willingness to invest	Recommendation to friends	Stock valuation	Stock Increase
Mann-Whitney U	113.000	83.000	65.000	97.000	95.500
Wilcoxon W	233.000	203.000	185.000	217.000	215.500
Z	-0.283	-1.509	-2.409	-0.919	-1.325
Asymp. Sig. (2-tailed)	0.778	0.131	0.016	0.358	0.185
Exact Sig. [2*(1-tailed Sig.)]	0.800 ^b	0.151 ^b	0.030 ^b	0.379 ^b	0.338 ^b
a Grouping Variable: Group					
b Not corrected for ties					

4.5.5 Effect of assurance level on investors' willingness to invest and stock valuation in case assurance quality is high

Comparing Group 1 (Big4 X Reasonable) with Group 3 (Big4 X Limited)

To investigate the impact of assurance level (reasonable vs. limited) in case the quality of assurance provided is high, the researcher compared the responses on the case questions between Group 1 (Big4 X Reasonable) and Group 3 (Big4 X Limited) using Mann Whitney test. It is clear from table (18) that in case the assessor is one of the Big4 audit firms, the reasonable assurance level conveyed in the assurance report will have a significant positive effect on investors' willingness to invest and stock valuation than in case the level of assurance conveyed is limited. This result shows how effective the level of assurance on investors' decisions, as even the assessor is a Big4 auditor, the investors' willingness to invest and stock valuation are affected by the different levels of assurance.

Table 18: Mann Whitney Test

(Impact of assurance level in case assurance quality is high)

Panel A: Ranks					
	Group	N	Mean Rank	Sum of Ranks	
Investment Opportunity	1	17	22.68	385.50	
	3	16	10.97	175.50	
	Total	33			
Willingness to invest	1	17	20.91	355.50	
	3	16	12.84	205.50	
	Total	33			
Recommendation to friends	1	17	19.12	325.00	
	3	16	14.75	236.00	
	Total	33			
Stock valuation	1	17	21.09	358.50	
	3	16	12.66	202.50	
	Total	33			
Stock Increase	1	17	19.94	339.00	
	3	16	13.88	222.00	
	Total	33			
Panel B: Test Statistics ^a					
	Investment Opportunity	Willingness to invest	Recommendation to friends	Stock valuation	Stock Increase
Mann-Whitney U	39.500	69.500	100.000	66.500	86.000
Wilcoxon W	175.500	205.500	236.000	202.500	222.000
Z	-3.591	-2.533	-1.660	-2.553	-2.169
Asymp. Sig. (2-tailed)	0.000	0.011	0.097	0.011	0.030
Exact Sig. [2*(1-tailed Sig.)]	0.000 ^b	0.015 ^b	0.204 ^b	0.011 ^b	0.074 ^b
a Grouping Variable: Group					
b Not corrected for ties					

4.5.6 Effect of assurance level on investors' willingness to invest and stock valuation in case assurance quality is low

Comparing Group 2 (Non-Big4 X Reasonable) with Group 4 (Non-Big4 X Limited)

To investigate the impact of assurance level (reasonable vs. limited) in case the quality of assurance provided is low, the researcher compared the responses on the case questions between Group 2 (Non-Big4 X Reasonable) and Group 4 (Non-Big4 X Limited) using Mann Whitney test. As shown in table (19), the investors' willingness to invest will be significantly higher in case the assurance level is high, even if it is offered by one of the non-Big4 audit firms. The researcher thinks that the insignificant effect of assurance level on investment opportunity might be because of the small sample size.

**Table 19: Mann Whitney Test
(Impact of assurance level in case assurance quality is low)**

Panel A: Ranks					
Group		N	Mean Rank	Sum of Ranks	
Investment Opportunity	2	16	18.56	297.00	
	4	15	13.27	199.00	
	Total	31			
Willingness to invest	2	16	19.28	308.50	
	4	15	12.50	187.50	
	Total	31			
Recommendation to friends	2	16	19.00	304.00	
	4	15	12.80	192.00	
	Total	31			
Stock valuation	2	16	17.97	287.50	
	4	15	13.90	208.50	
	Total	31			
Stock Increase	2	16	16.53	264.50	
	4	15	15.43	231.50	
	Total	31			
Panel B: Test Statistics ^a					
	Investment Opportunity	Willingness to invest	Recommendation to friends	Stock valuation	Stock Increase
Mann-Whitney U	79.000	67.500	72.000	88.500	111.500
Wilcoxon W	199.000	187.500	192.000	208.500	231.500
Z	-1.648	-2.110	-2.184	-1.269	-0.395
Asymp. Sig. (2-tailed)	0.099	0.035	0.029	0.205	0.693
Exact Sig. [2*(1-tailed Sig.)]	0.110 ^b	0.037 ^b	0.060 ^b	0.216 ^b	0.740 ^b
a Grouping Variable: Group					
b Not corrected for ties					

4.5.7 High Assurance Quality and Level vs. Low Assurance Quality and Level

Comparing Group 1 (Big4 X Reasonable) with Group 4 (Non-Big4 X Limited)

To investigate the interactive effect of assurance quality (Big4 vs. Non-Big4) and level (reasonable vs. limited), the researcher compared the responses on the case questions between Group 1 (Big4 X Reasonable) and Group 4 (Non-Big4 X Limited) using Mann Whitney test. Table (20) showed that in case the assurator is one of the Big4 audit firms (high) and the level of assurance is reasonable (high), investors will view the company as a good investment opportunity, will be willing to invest in its stocks, recommends it to their friends and accordingly they will value its stock at a higher level and expects that this value will increase in the coming 12 months. This result confirmed the findings of Hodge et al. (2009), which found that the interaction between assurance type and assurance level will enhance the users' reliability on the sustainability report.

Table 20: Mann Whitney Test (Impact of high assurance quality and level vs. low assurance quality and moderate assurance level)

Panel A: Ranks					
Group		N	Mean Rank	Sum of Ranks	
Investment Opportunity	1	17	21.62	367.50	
	4	15	10.70	160.50	
	Total	32			
Willingness to invest	1	17	22.29	379.00	
	4	15	9.93	149.00	
	Total	32			
Recommendation to friends	1	17	21.24	361.00	
	4	15	11.13	167.00	
	Total	32			
Stock valuation	1	17	21.29	362.00	
	4	15	11.07	166.00	
	Total	32			
Stock Increase	1	17	20.38	346.50	
	4	15	12.10	181.50	
	Total	32			
Panel B: Test Statistics ^a					
	Investment Opportunity	Willingness to invest	Recommendation to friends	Stock valuation	Stock Increase
Mann-Whitney U	40.500	29.000	47.000	46.000	61.500
Wilcoxon W	160.500	149.000	167.000	166.000	181.500
Z	-3.399	-3.850	-3.435	-3.141	-2.887
Asymp. Sig. (2-tailed)	0.001	0.000	0.001	0.002	0.004
Exact Sig. [2*(1-tailed Sig.)]	0.001 ^b	0.000 ^b	0.002 ^b	0.002 ^b	0.011 ^b
a Grouping Variable: Group					
b Not corrected for ties					

4.5.8 Effect of assurance quality on investors' reliance on management and assurance reports on cybersecurity risk management program

Supporting the research main results, the researcher examined the effect of assurance quality on the investors' reliance on management and assurance reports on cybersecurity risk management program. To do so, the researcher compared the participants' responses on the questions related to management report "Please indicate the extent to which you agree with the following statement: "I rely on the management's assertion in the cybersecurity risk management report to take my investment decision"? (0 = strongly disagree - 10 = strongly agree)" and assurance report "Please indicate the extent to which you agree with the following statement: "I rely on the assurator's report on cybersecurity risk management program to take my investment decision"? (0 = strongly disagree - 10 = strongly agree)" between Big4 group and non-Big4 group.

Using Mann Whitney test, table (21) provided evidence that investors' reliance increases significantly when the issuer of the assurance report is one of the Big4 audit firms than in case he/she is a non-Big4 auditor. However, the researcher didn't find significant difference in the investors' reliance on the management report between the two groups. This result is consistent with expectations that investors' reliance on management report will be the same and their reliance on assurance report will differ according to assurance quality (which is manipulated) (Mean rank = 38.03, $z = -2.490$, Sig. = 0.013). This result provides additional evidence that the manipulation of assurance quality in the experimental design is successful.

Table 21: Mann Whitney Test Results (Effect of assurance quality on investors' reliance on management and assurance reports)

Panel A: Ranks				
Assurance Quality		N	Mean Rank	Sum of Ranks
Management Report	Big4	33	35.11	1158.50
	Non-Big4	31	29.73	921.50
	Total	64		
Assurance Report	Big4	33	38.03	1255.00
	Non-Big4	31	26.61	825.00
	Total	64		
Panel B: Test Statistics^a				
	Management Report		Assurance Report	
Mann-Whitney U	425.500		329.000	
Wilcoxon W	921.500		825.000	
Z	-1.165		-2.490	
Asymp. Sig. (2-tailed)	0.244		0.013	
a Grouping Variable: Assurance Quality				

4.5.9 Effect of assurance level on investors' reliance on management and assurance reports on cybersecurity risk management program

As clear in table (22), the researcher found evidence that investors' reliance increases significantly when the assurance level shown in the assurance report is reasonable than in case it is limited. However, the researcher didn't find significant difference in the investors' reliance on the management report between the two groups. Again, it is expected that investors' reliance on management report will be the same between the two cases, however their reliance on assurance report will differ according to the assurance level (which is manipulated) (Mean rank = 37.18, $z = -2.108$, Sig. = 0.035). This result provides additional evidence that the manipulation of assurance level in the experimental design is successful.

Table 22: Mann Whitney Test Results (Effect of assurance quality on investors' reliance on management and assurance reports)

Panel A: Ranks				
Assurance Level		N	Mean Rank	Sum of Ranks
Management report	Reasonable	33	35.30	1165.00
	Limited	31	29.52	915.00
	Total	64		
Assurance report	Reasonable	33	37.18	1227.00
	Limited	31	27.52	853.00
	Total	64		
Panel B: Test Statistics^a				
	Management report		Assurance report	
Mann-Whitney U	419.000		357.000	
Wilcoxon W	915.000		853.000	
Z	-1.253		-2.108	
Asymp. Sig. (2-tailed)	0.210		0.035	
a Grouping Variable: Assurance Level				

5. Conclusion, Limitations, Recommendations and Implications for future Research

The objective of this study is to investigate the impact of assurance quality (Big4 vs. Non-big4) and assurance level (Reasonable vs. Limited) on investors' willingness to invest and stock valuation. Based on a sample of 64 MBA and postgraduate students in the faculty of commerce – Alexandria University and ESLSCA, the researcher found evidence that assurance on cybersecurity risk management program is highly valued by non-professional investors and affect their willingness to invest and stock valuation. In addition, experimental results showed that investors' willingness to invest and stock valuation will increase significantly in case the assurator is one of the Big4 audit firms (high assurance quality) and in case the level of assurance is reasonable than in case the assurator is a non-big4 audit firm, and the level of assurance is limited. On the other hand, no significant difference in the investors' willingness to invest or stock valuation in case the assurator is one of the Big4 audit firms (high assurance quality) and the assurance level is limited (moderate assurance level) and in case the assurator is a non-

big4 (low assurance quality) and the assurance level is reasonable (high assurance level).

This study and its results are subject to several limitations. First, the experiment involves MBA and postgraduate students as surrogates for non-professional investors. Although those participants might be similar to non-professional investors in their demographic characteristics, however their level of investment related experience might be lower than that of actual investors. Second, the financial information available to participants to evaluate the hypothetical company is summarized, however, in real life, investors might reach more information to take their investment decisions. Meanwhile, this limited information avoids other variables to affect the participants' evaluation and investment decisions.

These limitations offer adequate avenues for future research. First, as this experiment involves the case of a hypothetical company working in the retail industry, the researcher recommends future research to replicate this experiment on other sectors, such as telecommunication and technological sector, where higher inherent risk may amplify the impact of cybersecurity risk management efforts on investors' decisions. Second, as the participants in the experiment are MBA and postgraduate students, who represent a proxy for non-professional investors, future research may replicate this experiment on real investors, who might have different perception and valuation processes. Third, the case designed to investigate the impact of assurance quality and level on investment decisions assumed no cybersecurity incidents have occurred. Accordingly, different results might be reached in case the assurance on cybersecurity is offered after a cybersecurity crime or incident.

Despite the abovementioned research limitations, this study provides experimental evidence that non-professional investors appreciate the higher assurance quality and assurance level related to cybersecurity risk management program. Additionally, this study provides evidence that the higher assurance quality might be outweighed by the moderate assurance level and vice versa.

The research results indicate that it might be advantageous that standard setters and regulators emphasized the importance of assurance on cybersecurity risk management program and related controls and the role that auditors are playing in this regard.

Summary of Research Hypotheses and Results

No.	Hypothesis	Expected	Decision
H1	Investors' willingness to invest will increase significantly in case a Big4 auditor provides an assurance on the cybersecurity risk management program compared to a non-Big4 auditor	Significant positive effect	Supported
H2	Investors' stock valuation will be more favorable in case a Big4 auditor provides an assurance on the cybersecurity risk management program compared to a non-big4 auditor	Significant positive effect	Supported
H3	Investors' willingness to invest will increase significantly in case assurance on cybersecurity risk management program is reasonable compared to limited	Significant positive effect	Supported
H4	Investors' stock valuation will be more favorable in case assurance on cybersecurity risk management program is reasonable compared to limited	Significant positive effect	Supported
H5	Investors' willingness to invest will differ significantly in case assurance on cybersecurity risk management program is reasonable and offered by a non-Big4 auditor compared to limited and offered by a Big4 auditor	Significant effect	Not Supported
H6	Investors' stock valuation will differ significantly in case assurance on cybersecurity risk management program is reasonable and offered by a non-Big4 auditor compared to limited and offered by a Big4 auditor	Significant effect	Not Supported

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