IT Auditor and the overconfidence effect

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Seyed Jalaleddin Bani Hashemi
Executive summary

In accounting and auditing professional judgment is an increasingly important subject and professionals are required to apply sound professional judgment on a consistent basis. However, professionals such as IT auditors do not always follow a good judgment process because of systematic (predictable) judgment traps and tendencies which can lead to bias. Overconfidence, being one form of a cognitive bias, can create a mismatch between the IT auditors confidence in one’s own judgment and the real accuracy of these judgments. Calibration tests, a common method in the field of psychology, are used to measure the degree of overconfidence of junior (student IT auditors) and senior auditors (registered IT auditors).

Both junior and senior IT auditors showed high levels of miscalibration. Moreover, a statistically significant difference was found between junior and senior IT auditors: juniors were less calibrated than seniors. This study implicates that IT auditors could be facing legal problems due to misstatements, and misallocation of audit resources (e.g. staffing, IT). The results of this study suggest that it would be wise for junior IT auditors to collaborate with their seniors.

There are no specific mitigating actions targeting the overconfidence effect. IT audit practitioners can use the following measures to mitigate the overconfidence effect: Creating a professional sound working environment by encouraging diversity between auditors and encouraging auditor mobility (dynamic teams); Implementing professional standards and conducting periodic reviews (quality assurance). Obstacles for these mitigating measures are: Lack of knowledge (-sharing); Lack of awareness (e.g. reasoning behind the implementation of a measure); Inflexibility of people and resistance towards change; Sluggish decision making within mixed and diverse teams; and Pressures on time and costs.

A model describing the key decision moments of an audit that can be affected by the overconfidence effect was devised and validated by IT audit practitioners. The key decision moments are related to: plan of approach (scoping, timelines, resources), work-program (risks, controls and test-steps), amount of fieldwork performed, reporting (inclusion/exclusion of the to-be reported observations and findings, and risk determinations (high/med./low). This model can be used as an awareness tool in order to mitigate the overconfidence effect. The results of this study can also be used as a means to increase awareness on this topic.
Self-reflection and audit team reflections have potential to mitigate the overconfidence effect. Reflection is more effective when auditors understand the necessity (awareness) and when there is an open working environment (culture).
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1. Introduction

1.1 Problem statement

In accounting and (IT) auditing professional judgment is an increasingly important subject and professionals are required to apply sound professional judgment on a consistent basis. However, individuals incl. professionals such as IT auditors do not always follow a good judgment process because of systematic (predictable) judgment traps and tendencies which can lead to bias. Judgment can be described as the process of reaching a decision or drawing a conclusion where there are a number of possible alternative solutions and it typically occurs in a setting of uncertainty and risk. In the areas of auditing and accounting, judgment is typically exercised in three broad areas (KPMG 2009):

1. evaluation of evidence (e.g., does the evidence obtained provide sufficient appropriate audit evidence);
2. estimating probabilities (e.g., determining whether probabilities are reasonable);
3. deciding between options (e.g., choices related with audit procedures).

Overconfidence, being one form of a cognitive bias, can create a mismatch between the IT auditors confidence in one’s own judgment and the real accuracy of these judgments. Among other things, overconfidence can be described as the tendency of people to believe that their judgment is more accurate that it actually is in reality (Hardies et. al, 2011).

To our knowledge there have been no studies concerning IT auditor overconfidence although overconfidence may lead to (Owhoso and Weickgenannt, 2009):

- ineffective audits (misstatements), and could lead to legal problems,
- inappropriate staffing,
- inefficient use of technology, and misallocation of audit resources.

It may be worthwhile to know whether a seniority difference in IT auditor overconfidence exists given that it could have consequences for the auditor's professional judgment. In order to improve subjective judgment accuracy, (internal) audit firms allocate a lot of resources in the form of training programs. If a seniority difference in IT auditor overconfidence exists, training programs can be better tailored to focus on providing
feedback to reduce overconfidence and encourage auditors to formulate counter-arguments whenever exercising judgment (Hardies et. al, 2011).

1.2 Research delineation
Exploring IT auditors overconfidence to the full extent would be too complex and time consuming, therefore a research demarcation is needed.
Financial literature typically defined the concept of overconfidence under: miscalibration, the better than average effect, illusion of control, and unrealistic optimism (next section will elaborate these definitions). This study will focused on miscalibration as it is a principal fashion to establish overconfidence (Hardies et. al, 2011).
Another demarcation is that this study in only focused on IT auditors in the Netherlands and students from two Executive IT Audit universities will be part of the study.

1.3 Research objective
Based on the problem statement and research delineation, the main objective of this research is to:
explore the difference in overconfidence (miscalibration) between junior and senior IT auditors.

1.4 Research question
The main research question and corresponding sub-questions (RQ1-3) for addressing the main research objective:
how does overconfidence affect the judgment of the IT Auditor and which management controls can be taken?
1. What are cognitive biases and heuristics and what is the overconfidence effect?
2. How can the overconfidence effect be measured and what are the differences between junior and senior IT auditors?
3. In what way can IT auditors deal with overconfidence effects and how can this be implemented?

1.5 Research methodology
Over the years there has been extensive literature published about judgment and decision making, including the overconfidence effect. This literature is easily accessible through the university library. However, there is no data available from the IT auditor population. In
order to answer the sub-questions and eventually the main research question, desk research (literature study) and primary data collection is performed.

Google docs is used to survey calibration tests to junior and senior IT auditors digitally. Hand-outs (printed surveys) are also used to increase response rates.

The statistical program SPSS is used for performing independent samples t-test. The underlying reason for choosing SPSS is that the author is familiar with using SPSS in previous research.

1.6 Thesis structure
The next section will describe the relevance of overconfidence effect for IT audit professionals (section 2).
In section 3 a literature review of the overconfidence effect will be provided. Section 4 elaborates on the methodology to examine the overconfidence effect.
The results of this methodology is presented in section 5 and empirically validated in section 6. Moreover, in section 6 a model is presented and validated which addresses key decision moments that can be affected by the overconfidence effect.
Section 7 revisits the main research questions and discusses the practical- and theoretical-relevance of this study, its limitations and directions for further research.
2. IT audit professional and overconfidence

In this section the relevance of the overconfidence effect for IT auditors is clarified. Verkruijsse (2005) writes in his dissertation that auditors need to increase their level of transparency related to decisions made by professional judgment. Amongst others, he refers to the Sarbanes-Oxley Act of 2002. By being more transparent and sharing professional judgments, a body of knowledge regarding to professional judgment can be created that could support the auditor in future decision making. This body of knowledge helps the auditing profession to demonstrate solid standing regarding audit opinions which is not affected by subjective considerations. Moreover, individual auditors can be guided by the professional judgment of the auditing profession.

In other words, Verkruijsse acknowledges the fact that auditors are susceptible to systematic (predictable) judgment traps and tendencies which can lead to bias. And, by increasing their level of transparency on their decisions they are able to address bias.

Overconfidence, being one form of a cognitive bias, can create a mismatch between the IT auditors confidence in one’s own judgment and the real accuracy of these judgments. Among other things, overconfidence can be described as the tendency of people to believe that their judgment is more accurate that it actually is in reality (Hardies et. al, 2011).

As a consequence the IT auditor could lead ineffective audits resulting into misstatements, and possible, legal problems. Moreover, audit resources could be inefficiently utilized in the auditing process (e.g. inappropriate staffing and inefficient use of technology) as described by Owhosu and Weickgenannt (2009).

According to Verkruijsse, gaining understanding in professional judgments could have consequences in the training curriculum of auditors. It may become apparent that specific skills and capabilities are needed in order to form an adequate IT audit opinion as the quality of an IT audit opinion depends on the ability and experience of the auditor.
3. Literature review

This section focuses on the relevant literature concerning the overconfidence effect. An overview of overconfidence literature is provided alongside a definition for the overconfidence effect. Moreover, a description is given on how the overconfidence effect can be measured and what factors influence this effect. Finally, answers are provided for the following sub-questions:

1. What are cognitive biases and heuristics and what is the overconfidence effect?
2. How can the overconfidence effect be measured?

3.1 Cognitive biases

Cognitive biases originate from heuristics (e.g. rules of thumb, common sense). Mental shortcuts used to make judgments are called cognitive biases. In essence, biases are subjective opinions, decision rules and cognitive mechanisms that enable effective and efficient decision making yet deviate standard good judgment (Simon et al., 1999).

3.2 Definition of the overconfidence bias

Financial literature typically defined the concept of overconfidence under: miscalibration, the better than average effect, illusion of control, and unrealistic optimism. The issue of whether these notions are related is mainly unexplored. Miscalibration is the only concept defined as overconfidence in psychological research (Michailova, 2010).

3.2.1 Miscalibration

The cognitive bias related to the fact that people tend to overestimate the precision of their knowledge is called ‘Miscalibration’. In calibration tests participants provide answers to a number of questions and specify their level of confidence of being correct for each answer. Most individuals show overconfidence (miscalibration) by systematic deviating from correct answers and believing in the correctness of their answers while in reality the proportion of correct answers is actually lower than they would expect (Lichtenstein, et. al, 1982).

3.2.2 Better than average effect

The better than average effect refers to people who unrealistically think they have above average abilities such as skills and personal qualities compared to others (Taylor and
Brown, 1988). For example people think their driving skills are far more better than others while in reality this is not true (Sümer et al., 2006).

### 3.2.3 Illusion of control and unrealistic optimism

The illusion of control is related to the idea that people can exaggerate the degree of which they can control their fate. Typically, individuals underestimate the role of chance in their future affairs. Unrealistic optimism is closely related to the illusion of control and refers to the idea that the beliefs of most people are biased in the direction of optimism. In other words, optimists underestimate probabilities of unfavorable future events even when they have no control over them (Kahneman and Riepe, 1998). Optimistic overconfidence refers to the overestimation of probabilities related to favorable future events (Griffin and Brenner, 2005).

### 3.3 Measurement of overconfidence in empirical and experimental studies

#### 3.3.1 Proxies for Overconfidence

When proxies are used, the degree of overconfidence is not measured numerically and directly but by means of a proxy. For example via gender, which is based on the assumption that women are less overconfident than men (Barber and Odean, 2001). Taken choice (for ex. willing to bet on your own knowledge) is another proxy which has been used to measure over/under-confidence (Blavatsky, 2008).

#### 3.3.2 Overconfidence Measured via Tests and Tasks

In comparison to studies utilizing various proxies to measure overconfidence, questionnaire studies enable direct assessment of each subject’s under- or overconfidence (Michailova, 2010). For example, Biais, Hilton, Mazurier, and Pouget (2005) adapted the scale from Russo and Schoemaker (1992) to measure the degree of overconfidence in a group. For their test subjects had to provide 90% confidence intervals for 10 general-knowledge questions with known numerical answers.

In another example, subject’s overconfidence was measured by means of four tasks: 1. subjects stated their 90% confidence intervals for 20 knowledge questions; 2. subjects performed a self-assessment on their own performance in a knowledge task and assessed their own performance compared to others; 3. Subjects had to make 15 stock market
forecasts by stating 90% confidence intervals, and; 4. Subjects predicted a trend in stock prices forecasting via confidence intervals (Glaser, et. al, 2010).

3.4 Conclusion
The goal of this section was to provide answer to the following research sub-questions:

1. What are cognitive biases and heuristics and what is the overconfidence effect?
Cognitive biases and heuristics are mental shortcuts (deviating from good judgment) that individuals take for effective and efficient decision making. The overconfidence effect in this research is related to miscalibration: the fact that people tend to overestimate the precision of their knowledge.

2. How can the overconfidence effect be measured?
The overconfidence effect can be measured (indirectly) through proxies such as gender and taken choices but also by means of questionnaire studies (numerical measurement) that enable direct assessment of each subject’s under- or overconfidence.

The next section will elaborate on the method used to measure overconfidence in this study. As mentioned in section 1 (Introduction) this study will use a questionnaire study as this is a common method to measure overconfidence.
4. Method

This section will describe the methods that will be used in this study. First the dataset sample and procedures are discussed. Then the dataset questions and preparations are explained.

4.1 Sample and procedure

This study used a well-established format to measure overconfidence (calibration tests). Respondents were asked to answer 10 questions and each question had only one correct numerical answer. For each question respondents provided a 90% confidence interval (i.e., minimum and maximum estimates) they believed would contain the correct answer. If respondents would be well calibrated, only 10% of final values should fall outside the estimated 90% confidence intervals. The justification for asking respondents about general, and not specific, knowledge is based on the following reasons (Hardies et. al, 2011), and according to Simon et al. (1999), consistent with past research (e.g., Fischhoff, Slovic and Lichtenstein 1977; Russo and Shoemaker 1992):

- Using non-auditing tasks has the advantage that results of the study are not exclusively accredited to the specificities of the research instrument. Using an auditing task would introduce the problem that there would be no control condition. Consequently, it would be difficult to know if the results would be driven by the specificities of the population, or by the specificities of the task (i.e. inducing bias somehow).
- According to Mladenovic and Simnett (1994), auditing tasks are not inherently different to non-auditing tasks yet auditors are in some way different to non-auditors, this reduces the need to use an auditing task.
- Given that miscalibration scores have been shown to be consistent across tasks and domains. It is reasonable to presume that results of this study could be generalized to a context where respondents (auditors) are working on an auditing task (Jonsson and Allwood, 2003; Glaser et al., 2010).

The sample of respondents was based on NOREA (professional organization of IT auditors in the Netherlands) registered IT auditors and IT auditing students of two universities: Vrije Universiteit Amsterdam and Erasmus University Rotterdam. A digital survey was sent to (N=900) potential registered IT auditors and eventually 93 surveys were
completed: response rate (10%). Student IT auditors of the first and second year of the executive master of IT auditing were surveyed in class (N=71) with the option to also fill the form digitally. Eventually 66 surveys were completed: response rate (93%). The survey questions are depicted in the next section.

4.2 Dataset questions

• What is your age?
• What is your sex?
  o Male
  o Female
• What is your highest degree?
  o High school graduate
  o College degree
  o Bachelor's degree (or equivalent)
  o Master's degree (or equivalent)
  o Doctor's degree
  o Other:
• How many years of auditing experience do you have?
• Which of the following best describes your firm?
  o External audit (Big 4 and others)
  o Internal audit (government and enterprises)
  o Other:
• Which of the following best describes your position?
  o Partner
  o Director
  o Senior Manager
  o Manager
  o Senior Auditor
  o Auditor
  o Other:
• What are your professional certifications?
  Multiple answers are possible, for example: CISA CIA CPA
  o RE
  o RO
Give for each of the following ten questions a minimum and a maximum value so that you are 90 percent certain that the correct answer is within this range. You have to expect that you answer 10 percent of the questions (i.e. one question) wrong. The questions are not aimed at misguiding you and should (in cases of confusion) be interpreted in the most logical manner:

1a. What was Martin Luther King Jr’s age at death (Min. value)
1b. What was Martin Luther King Jr’s age at death (Max. value)
2a. In what year was J.S. Bach born (Min. value)
2b. In what year was J.S. Bach born (Max. value)
3a. How many countries belong to OPEC (Min. value)
3b. How many countries belong to OPEC (Max. value)
4a. How many books are there in the Old Testament (Min. value)
4b. How many books are there in the Old Testament (Max. value)
5a. How many companies went bankrupt in 2011, in Netherlands (Min. value)
5b. How many companies went bankrupt in 2011, in Netherlands (Max. value)
6a. How many independent, sovereign countries were there at the end of 2011 (Min. value)
6b. How many independent, sovereign countries were there at the end of 2011 (Max. value)
7a. What is the gestation of an Asian elephant, in days (Min. value)
7b. What is the gestation of an Asian elephant, in days (Max. value)
8a. What is the diameter of the moon, in kilometers (Min. value)
8b. What is the diameter of the moon, in kilometers (Max. value)
9a. What is the air distance from London to Tokyo, in kilometers (Min. value)
9b. What is the air distance from London to Tokyo, in kilometers (Max. value)
10a. What is the deepest known point in the ocean, in meters (Min. value)
10b. What is the deepest known point in the ocean, in meters (Max. value)

Correct answers:
1. What was Martin Luther King Jr’s age at death? 39
2. In what year was J.S. Bach born? 1685
3. How many countries belong to OPEC? 12
4. How many books are there in the Old Testament? 39
5. How many companies went bankrupt in 2011, in Netherlands? 9531
6. How many independent, sovereign countries were there at the end of 2011? 195
7. What is the gestation of an Asian elephant, in days? 645
8. What is the diameter of the moon, in kilometers? 3476
9. What is the air distance from London to Tokyo, in kilometers? 9560
10. What is the deepest known point in the ocean, in meters? 11033

4.3 Dataset preparations

Before the dataset can be analyzed several preparation processes are needed which are discussed in this section.

4.3.1 Missing value analysis

Missing Value Analysis (MVA) has been performed to determine the type of missing data and the required course of action. Typically, cases are dropped from analysis when the number of cases with missing data is <5%. The results of the MVA suggest that the missing values in the variables in the dataset is not that substantial to affect the results even if these missing values occur non-randomly: 1%.

4.3.2 Outlier analysis

Outliers or ‘extreme-values’ are observations that have distinctly different characterizations than other observations. Outliers can be beneficial if they can contribute to the interpretation of the results but otherwise they can be problematic. An outlier analysis has been performed on the dataset.

In order to detect outliers, the error was computed which was equal to |t – m|, where t is the true value and m is the midpoint of a given interval. Consequently, the sum of error values was sorted and analyzed. This resulted in the following:

Table 1 Cases with highest value for Error

<table>
<thead>
<tr>
<th>Extreme Values</th>
<th>Case Number</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>some Highest 1</td>
<td>136</td>
<td>1,E11</td>
</tr>
</tbody>
</table>
Table 2 Error percentile values

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>75</th>
<th>90</th>
<th>95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighted Average</td>
<td>5688,00</td>
<td>9291,00</td>
<td>15465</td>
<td>26239</td>
<td>58705</td>
<td>278143</td>
<td>3805480,00</td>
</tr>
</tbody>
</table>

Stem-and-Leaf Plot of the Sum of Errors

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Stem &amp; Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>17,00</td>
<td>0. 01112255666788999</td>
</tr>
<tr>
<td>34,00</td>
<td>1. 00000111111222223344455566777788999</td>
</tr>
<tr>
<td>42,00</td>
<td>2. 000000111111222223333444566777778889999</td>
</tr>
<tr>
<td>16,00</td>
<td>3. 001112235566789</td>
</tr>
<tr>
<td>5,00</td>
<td>4. 12245</td>
</tr>
<tr>
<td>6,00</td>
<td>5. 026788</td>
</tr>
<tr>
<td>7,00</td>
<td>6. 2223479</td>
</tr>
<tr>
<td>3,00</td>
<td>7. 168</td>
</tr>
<tr>
<td>1,00</td>
<td>8. 9</td>
</tr>
<tr>
<td>,00</td>
<td>9.</td>
</tr>
<tr>
<td>3,00</td>
<td>10. 368</td>
</tr>
<tr>
<td>1,00</td>
<td>11. 2</td>
</tr>
<tr>
<td>1,00</td>
<td>12. 0</td>
</tr>
<tr>
<td>23,00 Extremes</td>
<td>(&gt;=139775)</td>
</tr>
</tbody>
</table>

Stem width: 10000
Each leaf: 1 case(s)

Based on the analysis results, 23 cases which had a summed error value >=139775 (extreme Error values) were filtered from the dataset: the cases were related to responses of 10 registered IT auditors, 13 Student IT auditors.

Depicted below the top 5 cases with the highest error values and respondent’s answers (questions 1-10, including min. and max. estimates: a, b).
Table 3 Respondents answers from the top 5 cases with extreme error values

<table>
<thead>
<tr>
<th>Case</th>
<th>q1a</th>
<th>q1b</th>
<th>q2a</th>
<th>q2b</th>
<th>q3a</th>
<th>q3b</th>
<th>q4a</th>
<th>q4b</th>
<th>q5a</th>
<th>q5b</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>37</td>
<td>38</td>
<td>1685</td>
<td>1685</td>
<td>12</td>
<td>12</td>
<td>39</td>
<td>39</td>
<td>10000</td>
<td>10500</td>
</tr>
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<td>156</td>
<td>30</td>
<td>60</td>
<td>1000</td>
<td>1600</td>
<td>5</td>
<td>20</td>
<td>42</td>
<td>60</td>
<td>2000</td>
<td>3000</td>
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<td>96</td>
<td>59</td>
<td>59</td>
<td>1685</td>
<td>1685</td>
<td>12</td>
<td>12</td>
<td>39</td>
<td>46</td>
<td>9500</td>
<td>9600</td>
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<td>90000</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>45</td>
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<td>1800</td>
<td>1950</td>
<td>12</td>
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<td>3</td>
<td>500</td>
<td>2500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case</th>
<th>q6a</th>
<th>q6b</th>
<th>q7a</th>
<th>q7b</th>
<th>q8a</th>
<th>q8b</th>
<th>q9a</th>
<th>q9b</th>
<th>q10a</th>
<th>q10b</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>195</td>
<td>200</td>
<td>7665</td>
<td>7667</td>
<td>3400</td>
<td>3500</td>
<td>9600</td>
<td>9700</td>
<td>109110</td>
<td>110000</td>
</tr>
<tr>
<td>156</td>
<td>10</td>
<td>1000</td>
<td>360</td>
<td>720</td>
<td>1000</td>
<td>10000</td>
<td>0</td>
<td>1000</td>
<td>100000</td>
<td>1000000</td>
</tr>
<tr>
<td>96</td>
<td>203</td>
<td>206</td>
<td>21</td>
<td>21</td>
<td>3476</td>
<td>3476</td>
<td>9550</td>
<td>9560</td>
<td>110020</td>
<td>11000500</td>
</tr>
<tr>
<td>108</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>365</td>
<td>1</td>
<td>1E+09</td>
<td>1</td>
<td>90000</td>
<td>1</td>
<td>9999999</td>
</tr>
<tr>
<td>136</td>
<td>140</td>
<td>200</td>
<td>1</td>
<td>100</td>
<td>2E+08</td>
<td>2E+11</td>
<td>1000</td>
<td>1E+09</td>
<td>400</td>
<td>4000</td>
</tr>
</tbody>
</table>

4.3.3 Normality analysis

The distribution of the HITRATE (dependent variable) was explored. The histograms here below and tests of normality show that the dependent variable is not approximately normally distributed for each category of the independent variable (Student IT auditor/Registered IT auditor).

The test below indicates that the data related to the dependent variable significantly differs from the normal distribution (Sig.<0.05). Moreover, the non-normal distribution is depicted in the graph here below.

Table 4 Tests of Normality dependent variable

<table>
<thead>
<tr>
<th>Tests of Normality</th>
<th>Kolmogorov-Smirnov²</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>df</td>
</tr>
<tr>
<td>Hitrate RE</td>
<td>.101</td>
<td>83</td>
</tr>
<tr>
<td>StudentRE</td>
<td>.180</td>
<td>53</td>
</tr>
</tbody>
</table>

a. Lilliefors Significance Correction
Figure 1 Histogram dependent variable for subgroup Registered IT auditors

Figure 2 Histogram dependent variable for subgroup Student IT auditors
4.3.4 Homogeneity of variance
The results below indicate that there was homogeneity of variances between the subgroups of Student IT auditors and Registered IT auditors (p=.333 > 0.05), as assessed by Levene's Test for Equality of Variances.

Table 5 Levene's Test for Equality of Variances

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variance</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.941</td>
<td>.331</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>2.116</td>
<td>177.351</td>
</tr>
</tbody>
</table>

4.3.5 Conclusion
Before analysis can take place, the assumptions for the Independent T-test have been analyzed:

- The dependent variable (HITRATE) is measured at interval level.
- The independent variable (2 groups: Student IT auditors, Registered IT auditors) consist of two categorical, independent groups.
- There is no relationship between the observations in each group or between the groups themselves. In other words: different participants are in each group with no participant in more than one group.
- There are no significant outliers.
- The dependent variable is not approximately normally distributed for each category of the independent variable.
- There is homogeneity of variances.

Based on our analysis there is only 1 violation, namely the non-normal distribution of the dependent variable. Instead of the independent-samples T-test, several non-parametric tests (e.g. Mann-Whitney and Wilcoxon test) will be used for our analysis as these tests do not require normal distribution of the dependent variable.
5. Results

This section will present the results based on the method described in the previous section. To examine our research sub-question (what are the differences between junior and senior IT auditors?) the following experiment was performed. Before presenting the results the demographics of the respondents are given in the next section.

5.1 Demographics respondents

The respondent demographic characteristics that were explored for both student- and Registered IT auditors were as follows:

- Age (distribution);
- Gender (% Male vs. Female);
- Education (level);
- Position (within an organization).

*Figure 3 Age distribution of Student IT auditors*
Figure 4 Age distribution of Registered IT auditors

Table 6 Gender distribution of registered IT auditors

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>74</td>
<td>89,2</td>
<td>89,2</td>
<td>89,2</td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>10,8</td>
<td>10,8</td>
<td>100,0</td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>100,0</td>
<td>100,0</td>
<td></td>
</tr>
</tbody>
</table>

Table 7 Gender distribution of student IT auditors

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>43</td>
<td>81,1</td>
<td>81,1</td>
<td>81,1</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>18,9</td>
<td>18,9</td>
<td>100,0</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>100,0</td>
<td>100,0</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5 Education level of IT auditors

![Education Level of IT Auditors](image)

<table>
<thead>
<tr>
<th>Education</th>
<th>Student IT Auditor</th>
<th>Registered IT Auditor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor’s degree</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Master’s degree (or equivalent)</td>
<td>40</td>
<td>73</td>
</tr>
<tr>
<td>Bachelor’s degree (or equivalent)</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>High school graduate</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 6 Working firms of IT auditors

![Working Firms of IT Auditors](image)

<table>
<thead>
<tr>
<th>Firm</th>
<th>Student IT Auditor</th>
<th>Registered IT Auditor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Self-employed</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>External audit</td>
<td>37</td>
<td>18</td>
</tr>
<tr>
<td>Internal audit</td>
<td>13</td>
<td>53</td>
</tr>
</tbody>
</table>
Figure 7 Position of IT auditors

Figure 8 Numbers of years experience student IT auditor
Figure 9 Numbers of years experience registered IT auditor

Histogram

Registered IT Auditor

Range | Frequency
--- | ---
0-5 | 5
5-10 | 10
10-15 | 15
15-20 | 20
20-25 | 25
25-30 | 30
30-35 | 35
35-40 | 40

Mean = 13.8, Std. Dev. = 7.286, N = 83

Summary of respondents demographics

The table below shows the summary of the demographics analysis of the respondents (student and registered IT Auditors).

Table 8 Summary demographics student- and registered IT auditors

<table>
<thead>
<tr>
<th></th>
<th>Age (years)</th>
<th>Gender</th>
<th>Education</th>
<th>Working firm</th>
<th>Position</th>
<th>Experience (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student IT auditor</strong></td>
<td>Mean=30.7, Std. Dev=6.5, N=52</td>
<td>Predominantly Male (89%)</td>
<td>Typically Master of Science</td>
<td>External audit</td>
<td>Typically Auditor/ Senior auditor</td>
<td>Mean=2.9, Std. Dev=2.8, N=49</td>
</tr>
<tr>
<td><strong>Senior IT auditor</strong></td>
<td>Mean=44.1, Std. Dev=8.8, N=83</td>
<td>Predominantly Male (81%)</td>
<td>Typically Master of Science</td>
<td>Internal audit</td>
<td>Typically Senior auditor/ (Senior) manager</td>
<td>Mean=13.8, Std. Dev=7.3, N=83</td>
</tr>
</tbody>
</table>
5.2 HIT RATE
The ‘HIT RATE’ refers to the number of 90% confidence intervals (min. and max. estimates) given by respondents of which the true value a question fell and is a typical measure to assess interval estimates (Lichtenstein et al., 1982; Klayman et al., 1999; Soll and Klayman, 2004).

5.3 INTERVALSIZE
The ‘INTERVALSIZE’ referring to (max. value – min. value) estimates given by respondents was computed as a measure to determine the informativeness of provided confidence intervals (Yaniv and Foster, 1997). Narrower intervals can be considered more informative as wider intervals increase the HIT RATE (McKenzie et al., 2008).

5.4 ERROR
The ERROR refers to |t – m|, where t is the true value and m is the midpoint of a given confidence interval. When INTERVAL SIZE is kept constant, reducing ERROR will generally increase HIT RATE (McKenzie et al., 2008).

5.5 Hypotheses
If individuals would be well calibrated, only 10% of final values should fall outside the estimated 90% intervals. In this experiment, the following hypothesis was tested:
H1. The HIT RATES of junior and senior IT auditors will not differ.
If a seniority difference in overconfidence (HITRATE) within the population of IT auditors is found, this may be caused by differences in INTERVAL SIZE or by differences in ERROR. Individuals with lower ERROR are presumably more knowledgeable, individuals with narrower INTERVAL SIZE are presumably more confident in their judgment. This reasoning leads to the following hypotheses:
H2. INTERVAL SIZES will be as narrow for junior as for senior IT auditors.
H3. ERROR will be the same for junior and senior IT auditors.

5.6 Summary of results
HIT RATE was determined for each participant for the set of questions by dividing the number of times the provided confidence interval contained the true value by the number of questions. If the true value fell within the given it was counted as a hit.
If respondents would be well calibrated, only 10% of final values should fall outside the estimated 90% confidence intervals (one out of ten questions). INTERVAL SIZE and ERROR were computed as described above.
The overall HIT RATE was 36.5% (Std. Dev=24.3), replicating previous findings of extreme overconfidence. HIT RATE was slightly higher for senior auditors (Mean=39.9%, Std. Dev.=24.8) than for junior auditors (Mean=31.1%, Std. Dev.=22.7), the difference was statistically significant (p = 0.032). H1 can be rejected based upon our data, statistical details are presented in Appendix 1.

INTERVAL SIZE was computed for all ten questions and indicated that senior IT auditors provided more informative intervals for two questions than junior auditors (p-values ranging from 0.03 to 0.89) (Appendix 2). H2 was rejected based upon our data.

ERROR for seven questions was not the same for junior as for senior IT auditors (p-values ranging from 0.00 to 0.282) which indicates that seniors are presumably more knowledgeable (Appendix 3). H3 was rejected by our data.

The table below provides a summary of the aforementioned. The specific values for INTERVAL SIZE and ERROR are not reported since these values are not very informative and averaging them is meaningless.

<table>
<thead>
<tr>
<th></th>
<th>Junior auditors (n=53)</th>
<th>Senior Auditors (n=83)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIT RATE</td>
<td>31.1%</td>
<td>39.9%</td>
<td>(p=.0032)</td>
</tr>
<tr>
<td>INTERVAL SIZE</td>
<td>n.a.</td>
<td>n.a.</td>
<td>(p=.03)</td>
</tr>
<tr>
<td>ERROR</td>
<td>n.a.</td>
<td>n.a.</td>
<td>(p=.00)</td>
</tr>
</tbody>
</table>
6. Empirical validation of the overconfidence effect

This study measured a strong overconfidence effect for both junior and senior IT auditors as both groups showed high levels of miscalibration. Moreover, a significant difference was found between junior and senior IT auditors: juniors were less calibrated than seniors (previous section). This section focuses on dealing with the overconfidence effect in order to provide an answer for the following sub-question: In what way can IT auditors deal with overconfidence effects and how can this be implemented?

6.1 Approach

In order to understand how the effects of overconfidence can be mitigated and specifically by what measures, the following empirical approach was carried out:

1. Desk research on mitigating actions for the overconfidence effect
2. Proposal of a model with key decision moments for the IT auditor
3. Three-stage structured interviews with IT audit practitioners

   I. Presentation of the results of the this study followed up by the following questions:
      i. Given these results (existence of overconfidence) what are the consequences for IT auditing?
      ii. In practice, how do you deal with the overconfidence effect?
      iii. What measures do you take to mitigate the overconfidence effect?
      iv. How can these measures be implemented?
      v. What are the obstacles regarding the implementation of these measures?
      vi. How does the overconfidence effect affect IT auditors?

   II. Presentation of mitigating actions based on desk research.
      i. Interviewees were asked to perform feasibility check on mitigating actions for the overconfidence effect.

   III. Presentation of a model depicting key decision moments which may be affected by the overconfidence effect.
      i. Interviewees were asked to perform a plausibility check on these decision moments with respect to the overconfidence effect.
This approach not only allowed the interviewees to provide mitigating actions regarding the overconfidence effect but it also enabled them to validate mitigating actions based on desk research. Also, interviews validated a model which provides key moments that could be affected by the overconfidence effect.

*Figure 10 Approach depicting mitigating actions*

The following IT audit practitioners were interviewed:

- ing. A.A.C. de Visser RE CISSP (IT audit manager)
- drs. M.A.E. le Comte RE MTD EMITA (IT audit manager)
- I.J.M. Vettewinkel-Raymakers RE (IT audit director)
- E. de Vries RE CISA CIA CISSP (IT audit manager)
- ir. H.T. Pellegrrom RE CISA CIA (IT audit manager)
- drs. E.J.M. Ridderbeekx RE CISA (Senior IT audit manager)
- ir. M. Zwiers RE (Senior IT audit manager)

Interviewees were requested to review the interview notes and conclusions. All interviewees responded to the review request and provided feedback.
6.2 Mitigating actions based on desk research

6.2.1 The Wisdom of the Crowds
James Surowiecki (2005) writes in his book “The Wisdoms of the Crowds” that the average judgment of a group is almost always better than an individual judgment. For example, if someone wanted to know the weight of an elephant, the averaged value of guesses of a crowd would be closer to the real value than individual guesses. And, this averaged value would even be closer than expert estimates. In order for this theory to work, individuals need to:

- keep loose ties with one another (independence);
- be exposed to as many diverse sources of information as possible (diversity of opinion);
- their groups should range across hierarchies (decentralization);
- have a mechanism in place to facilitate collective decisions (aggregation of knowledge).

6.2.2 Self reflection and decision diary
Prof. Jill Klein (2010) describes the following remedies specifically for miscalibration. These recommendations are generally related to awareness and self reflection, e.g. being critical with one’s own judgment:

- Averaging even 1 other option with yours is an improvement
- Averaging even your own 2nd opinion with your 1st opinion is an improvement
- Thinking about extremes before the middle
- Separate “deciding” from “doing”
  - Be a realist when deciding; confine optimism to implementation
- Be contrarian
  - Ask yourself “why might I be wrong?”
- Don’t demand high confidence and narrow intervals from others
- Try to better calibrate your meta-knowledge
  - Practice and look for feedback
- Keep a Decision Diary
  - Be honest with yourself
  - Don’t rationalize failures (all failures must count)
  - Define specific objectives and what constitutes success at the outset
Example template of a decision diary:

<table>
<thead>
<tr>
<th>Date</th>
<th>Decision to be Made</th>
<th>Decision Definition of Success</th>
<th>Date for Evaluation</th>
<th>Evaluation</th>
<th>Learning’s</th>
</tr>
</thead>
</table>

### 6.3 Key decision moments model

Typically, an audit undergoes a number of key phases resulting into a number of key decision moments, please refer also below to figure 11:

1. After orientation the terms of reference or plan of approach (in Dutch: “plan van aanpak”) is created which defines the scope of the audit object and the goal of this audit. The decision on what should be part of the audit scope can be considered a key decision moment.

2. After the scope has been defined usually a work-program is defined which describes the risks, controls and test steps that are to be checked for the audit. The decision on what risks, controls and test-steps are part of the work-program can be regarded as a key decision moment.

3. The decision on the amount of fieldwork can be considered a key decision moment.

4. Another key decision moment is related to the reporting, the inclusion/exclusion of the to-be reported observations and findings.

5. Finally, assigning risk indications (e.g. high-medium-low) is also key decision moment.

**Figure 11 Key decision moments model**

![Key decision moments model diagram](image)

The key decisions model was presented to IT audit practitioners. Interviewees were asked to perform a plausibility check on these moments with respect to susceptibility for the overconfidence effect. The results are presented in section 6.6.
6.4 IT audit practitioner mitigating actions

The results of this study: overconfidence effect measured for both IT audit juniors and seniors (previous section) was presented to IT audit practitioners. Subsequently, practitioners were asked to provide answers to the following questions in order to understand how the effects of overconfidence can be mitigated and specifically by what means. The responses of the interviewees (I-VII) are presented under each question.

1. **Given these results (existence of overconfidence) what are the consequences for IT auditing?**

   I. An element of uncertainty is introduced in audit products because judgment & decision making of auditors is influenced by the overconfidence effect. Based on the research/survey results this cannot be denied. Overconfidence therefore affects each audit stage when decisions take place: work-program, risk indication, etc. The results of this study suggest that it would be wise for junior IT auditors to collaborate with their seniors.

   II. It can have severe consequences for the auditor that makes misstatements, he/she can be expelled from the professional organization of IT auditing (e.g. NOREA). This study shows the importance of having sufficient knowledge (of the auditing object) and skills before conducting an audit.

   III. The IT auditor could rely too much on his own assumptions, thinking that he knows best. IT auditors should be more careful with their judgments and not jump to conclusions.

   IV. Limited assurance is provided instead of reasonable assurance. It is important to know where a misstatement is given and on what level.

   V. The results suggest that if an audit would have been conducted solely by a junior IT auditor it would be less reliable than performed by a senior: the reasonable amount of assurance is affected.

   VI. This study indicates that there are risks that misstatements are given (audit risk) and that there is a risk in decision making based on audit results.

   VII. IT auditors need to be stimulated to use multiple sources of information (e.g. triangulation). Second readership is important. Awareness about the overconfidence effect needs to be increased as many IT auditors are not familiar
with the concept. Sharing the results of this study can help increase awareness as the overconfidence effect needs to be addressed.

2. In practice, how do you deal with the overconfidence effect?

I. No special attention is paid to the overconfidence effect. There is little awareness of the phenomenon in the audit community. But even auditors are aware, no explicit countermeasures are taken to compensate for this phenomenon. Generally speaking, for example when the audit team creates a work-program this is reviewed by the audit manager. Reflection moments could perhaps lower the effects of overconfidence.

II. In our audits we do not allow an auditor to define the scope/ work-program/ report of an audit without approval by a colleague of sufficient level, an audit manager (or audit lead) should always perform a review. Proper orientation before an audit is also very important and it would be helpful in addressing overconfidence.

III. By listening and asking questions until reliable and conclusive information has been gathered.

IV. It is important to know what is the impact of a misstatement: has the target totally been missed or was there a minor offset and the target was within range.

V. Typically junior and senior IT auditors (mixed teams) are part of an engagement. Auditors should be cautious before making decisions. Awareness about this subject is important as well as challenges that are provided from the audit team.

VI. I try to keep asking questions and continuously challenge myself and my colleagues. It is important that auditors feel free to discuss and challenge each other’s work. Our work is (and should be) subject to (peer-) reviews and quality control.

VII. IT audit team composition is important and mixing auditors with distinctive competences and skills can help address this issue. Peer-reviews such as second readership can help. It is important that auditors realize that it is important to listen and conduct their audit with due professional care.

3. What measures do you take to mitigate the overconfidence effect?

I. None. If the overconfidence effect also applies to knowledge this could lead to the believe that you are knowledgeable on a particular topic when actually you are not. If I feel a lack of knowledge on a certain matter I perform desk research. I try to be reflective on my decisions as much as I can.
II. In terms of education, the VERA master course (permanent education, Nyenrode Business University) has paid a lot of attention to cognitive biases. Several review steps (scope, work-program, report) are part of our audit process, but not consciously to address the overconfidence effect. These reviews should be performed by auditors outside the engagement team.

III. Challenging each other within an audit team is important, for example for scoping, after interviews, organizing findings and writing recommendations. Changing the composition of audit teams to keep auditors sharp.

IV. Diverse teams could help but does not guarantee anything as team members still can influence each other resulting in a misstatement. It is more important to know how open are team members towards each other’s arguments. Also, not in all cases auditors can be switched between teams (lack of expertise).

V. Challenging, for example second readership takes place during the audit. Also peer-reviews take place.

VI. I keep my knowledge up to date by participating in trainings (e.g. permanent education). I participate in challenging sessions and peer reviews.

VII. We stimulate auditors to keep their knowledge up to date (e.g. permanent education) and participate in diverse teams. Special attention is given to second readership and we invest in our auditors (e.g. interview training, feedback training). Asking critical questions, and following-up on important leads is key to improve the audit.

4. How can these measures be implemented?

I. Not applicable.

II. Professional practice standards have been implemented and compliance is periodically reviewed (Quality Assurance).

III. More engagement within the audit team but also with the auditee. Encouraging mobility of auditors between teams. Encouraging diversity (gender/ education/ cultural background) within audit teams. Moving from static to a more dynamic audit planning. Letting the planning being dependent of the audit scope.

IV. An open culture where auditors can learn and challenge each other and by doing so keeping everyone sharp.

V. Reviews and challenges cannot take place on solo audits. Diverse teams are well suited for peer-reviews. A successful implementation requires planning and adequate
resourcing. Reviews -after an audit- could also provide insight whether there was any overconfidence.

VI. By means of a professional sound environment. One also needs certain (self-imposed) quality requirements and guidance. Awareness on the subject is also important (this study can help raise awareness).

VII. The skills of our auditors is tracked and matched with the skills that our organization needs in order to provide audit coverage.

5. What are the obstacles regarding the implementation of these measures?
   I. Not applicable.
   II. Auditors experience the amount of documentation and filing related to compliance with professional standards as bureaucratic and in general have limited understanding of the benefits.
   III. Inflexibility of people and resistance towards aforementioned changes. Lack of knowledge and sharing of knowledge. Lack of seeing the-big-picture and seeing things in perspective.
   IV. Having an open culture can lead to many discussions and not many decisions (inefficiencies). Decision making within diverse teams can be troublesome when roles and responsibilities are not clear.
   V. Usually self-reviews are less reliable than reviews performed by others (preference). There are not many issues regarding diverse teams other than one needs a large enough pool of people with the required expertise and knowledge.
   VI. Disbelief, over-rationalising, positivistic approach of auditors. Pressures on time and costs. Jumping to conclusions. Not all facts are directly measurable, subjectivity is part of some measurements.
   VII. We see no obstacles in improving the skills of our auditors and we are busy with this process. That being said it is a matter of having a vision, choosing a direction and implementing skill improvement initiatives.

6. How does the overconfidence effect affect IT auditors?
   I. It makes predictions and risk assessments of IT auditors less precise.
   II. IT auditors rely heavily on professional judgment. For example, how should one quantify the associated risks of a security breach? Therefore, the IT auditor is susceptible to many biases, incl. overconfidence. The results of this study can
increase the awareness related to overconfidence. Overconfidence can affect the IT auditor on many aspects of the audit engagement where decisions are to be made. For example regarding the composition of the work program.

III. Overconfidence can affect the IT auditors assumptions and conclusions. For example regarding audit opinions and risk ratings.

IV. IT auditing is a tricky business (e.g. misstatements and judicial consequences) if the overconfidence effect is not addressed.

V. Both junior and senior IT auditors need to realize (awareness) that their audit assurance can be affected by the overconfidence effect. They also need to be more reflective on their decisions.

VI. IT auditors should realize that there is a limit on the objectivity of their judgments that possibly affects the assurance they give. Extra attention should be paid to getting the facts right. Also, estimations should be offered to peers for review to increase reliability. This requires transparency of analysis and opinion-forming.

VII. IT auditors need to conduct their audits thoroughly expressing modest behavior. Auditors need to be critical towards the value they give towards presented evidence knowing that overconfidence exists.

6.4.1 Analysis and conclusion of expert panel
According to IT audit practitioners, the consequences of the overconfidence effect for IT auditing are as follows:

- an element of uncertainty is built-in the IT audit product when the scope is inadequate or when the audit is not thoroughly executed, as of consequence limited assurance is provided instead of reasonable assurance;
- each stage of the IT audit where decisions take place can be affected: work-program, risk rating, audit opinions, etc.;
- the IT auditor could make misstatements and become expelled from the professional organization of IT auditing (e.g. NOREA).

IT audit practitioners deal with the overconfidence effect as follows:

- there are no specific mitigating actions targeting the overconfidence effect;
- some practitioners rely on team reviews.

IT audit practitioners use the following measures to mitigate the overconfidence effect:
- being self-reflective on their decisions and their peers, and challenging these decisions;
- following professional standards, guidelines, and training.

IT audit practitioners have implemented the aforementioned measures as follows:
- creating a professional sound working environment: encouraging diversity between auditors and encouraging auditor mobility (dynamic teams);
- implementing professional standards and conducting periodic reviews (quality assurance).

Obstacles for the overconfidence effect mitigating measures are as follows:
- lack of knowledge (-sharing);
- lack of awareness (e.g. reasoning behind the implementation of a measure);
- inflexibility of people and resistance towards change;
- sluggish decision making within mixed and diverse teams;
- pressures on time and costs.
6.5 Feasibility check on mitigating actions based on desk research

Interviewees were asked to perform a feasibility check on the mitigating actions for the overconfidence effect based on desk research (section 6.2). The responses of the interviewees (I-VII) are presented under each mitigating action.

6.5.1 Wisdom of the crowds

I. An interesting idea, however certain aspects first need to be worked out before it can be used for IT auditing. For example, when one is dealing with confidential information, the “wisdom of the public crowd” cannot be used. Also, who is willing to participate? And, how many people should participate to have a reliable crowd? It can be useful in the internal audit “crowd”, however the specific implementation needs to be researched further.

II. I am a professional and I know my profession. I do not need the crowd for subject matters within my expertise. For risk indications it can be useful to use the knowledge of the crowd. For example, I auditor knows probably less what the consequences are of a DDOS attack than the organization that is affected.

III. Gathering input from different cultures, ages and disciplines can improve information quality. This instrument could have potential, yet there are questions that need to be answered such as: in what phase of the audit should “the crowd” be used? Perhaps in certain situations the “wisdom of the department” can be queried.

IV. In order to use the wisdom of the crowds the question needs to be very clear and specific. Also, if responses are anonymous, how much value does an answer have? Perhaps this instrument is only useful within an organization/community. Consequently, the question rises how large should such a community be? Moreover, this instrument seems more effective for areas of common knowledge rather complex area’s that require specific knowledge (expertise is required).

V. Within an organization it could prove useful yet practical questions such as how large the group should be? need to be answered. Using a crowd outside an organization does not seem practical, only within an organization and perhaps within the audit discipline. For example, frameworks, best practices are also created by the crowd. There is also the body of knowledge (IIA) and professional communities
Moreover, there are professional guidelines and certifications all building upon community knowledge.

VI. The usefulness of the wisdom of the crowd decreases as an audit progresses. For example, during the determination of the audit scope it can be useful while it may be less useful when an auditor forms the audit opinion. Generally the knowledge of the crowd is used in the professional environment: peer reviews and meetings.

VII. Team discussions can be considered as a form of using the wisdom of the crowds. For example when deciding on a risk rating. Another example is in the exploration phase of the audit planning: which risks are to be considered. Different phases of the audit could perhaps benefit from this method. If one is for example working on a AS400 audit, the “crowd” can be queried for information (e.g. key risks, etc.).

6.5.2 Decision log

I. If there is bias this will also be put in the log. So it will probably not mitigate the effects of overconfidence. Yet, the decision log can be useful for review purposes by others.

II. I believe that the pure documentation of decisions will not help mitigating the effects of overconfidence. Describing the rationale behind decisions provides transparency and could even affect the decisions being made, recording should take place before the decision is made public. Decisions should be recorded even though many would argue that it is bureaucratic.

III. Logging has the risk that it can become rather a chore than an intelligently performed task. Decision logging makes no sense if it is not challenged by someone. Logging does help provide insight on how a person has come to certain decisions.

IV. Can be useful for review activities (e.g. who has done what), question is how much time and priority should be placed in filling the log and what are the benefits? One should always consider the costs and benefits of using such a log. For example one could consider the consequences of a misstatement given a certain test being performed.

V. Recording decisions will not help mitigate the overconfidence effect. Most likely it will only be treated as a checklist. It may be useful if one would make explicit -why a certain decision was made which basically forces the auditor to reflect on the decisions that have been taken.

VI. The decision diary is already part of our audit process. Auditors are required to state on what basis (evidence) they come to a certain conclusion.
VII. Logging has limited benefits addressing the overconfidence effect. It can serve as an audit trail how an auditor has come up to a certain conclusion.

6.5.3 Reflection

I. Self-reflection can mitigate the effects of overconfidence. When an auditor has certain doubts and has to make these explicit this can perhaps mitigate the effects of overconfidence.

II. I am a fan of reflection. Reflection would definitely help if professionals have the time to execute it properly. We exercise reflection at the end of the audit but its more concerning the audit process rather than the audit substance, having time available for reflection on the content would be useful.

III. Making use of the crowd is a form of reflection. Auditors should take certain moments for themselves and reflect on their decisions. For example after devising a plan of approach (scoping). Moreover, auditors should also reflect on themselves when peer-reviewing other auditors reports. Auditors can learn a lot from each other if they are more reflective towards themselves and their peers.

IV. Effective if properly used within an audit team. Team challenges are the best form of reflection. The working environment should have a culture that enables auditors to reflect on themselves and their colleagues.

V. Reflection on the audit process can provide certain insight on the decisions that have been made. The precondition is that the auditors are open and critical. Reflection on hours spent and scope realization provide no insight on the overconfidence effect.

VI. Self reflection needs be performed more often, it has to do a lot with self discipline. In the current form reflection is regulated not on the basis of free will but because it is part of the audit methodology that is implemented. For example, auditors are required to perform peer reviews. Training and awareness can provide auditors insight on the importance of reflection.

VII. When is reflection not useful? For audits reflection is always important. It is good to reflect on an audit and ask yourself if you would come to the same decision. The auditor needs to be critical to him/herself, not reflecting implies that one is overconfident by nature.
6.5.4 Analysis and conclusion of expert panel
The wisdom of the crowds needs to be researched further before it can be used by IT audit professionals to mitigate the overconfidence effect. Currently, many questions remain to be answered before this instrument can be used.

According to IT audit practitioners the decision diary will not help mitigate the effects of the overconfidence effect. It may only be useful for reviewing purposes.

Self-reflection and audit team reflections have potential to mitigate the overconfidence effect. Reflection is more effective when auditors understand the necessity (awareness) and when there is an open working environment (culture).
6.6 Plausibility check on key decision moments model

Interviewees were asked to perform a plausibility check on the key decision moments model (section 6.3).

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<td>V</td>
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<tr>
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<tr>
<td>VII</td>
<td>Yes</td>
<td>(When applicable) Annual audit planning, Quality Assurance runs through all processes and could mitigate the overconfidence effect and other biases. It is recommended that future studies focus on soft controls</td>
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</table>

6.6.1 Conclusion

All IT audit practitioners found it plausible that the key decision moments presented in the model can be affected by the overconfidence effect. Moreover, the model can be extended with another key decision moment: annual audit planning when the audit is part of a larger planning.
7. Research question revisited

In this section the theoretical relevance of this study alongside the practical relevance is presented. Finally a reflection is given on the process of conducting this study.

The main research objective of this study was to explore the difference in overconfidence (miscalibration) between junior and senior IT auditors. Consequently, the main question that was stated in order to meet this objective was stated as follows:

How does overconfidence affect the judgment of the IT Auditor and which management controls can be taken?

In order to answer this question, three sub-questions were stated (RQ1-RQ3); first the answers to these sub-questions are given which will form the basis of answering the main research question.

RQ1: What are cognitive biases and heuristics and what is the overconfidence effect?
Cognitive biases are heuristics are mental shortcuts (deviating from good judgment) that individuals take for effective and efficient decision making. The overconfidence effect in this research is related to miscalibration: the fact that people tend to overestimate the precision of their knowledge.

RQ2: How can the overconfidence effect be measured and what are the differences between junior and senior IT auditors?
The overconfidence effect can be measured (indirectly) through proxies such as gender and taken choices but also by means of questionnaire studies (numerical measurement) that enable direct assessment of each subject’s under- or overconfidence.

This study measured a strong overconfidence effect for both junior and senior IT auditors as both groups showed high levels of miscalibration. Moreover, a significant difference was found between junior and senior IT auditors: juniors were less calibrated than seniors.

RQ3: In what way can IT auditors deal with overconfidence effects and how can this be implemented?
There are no specific mitigating actions targeting the overconfidence effect. IT audit practitioners use the following measures to mitigate the overconfidence effect:

- being self-reflective on their decisions and their peers, and challenging these decisions;
- following professional standards, guidelines, and training.
IT audit practitioners have implemented the aforementioned measures as follows:

- creating a professional sound working environment: encouraging diversity between auditors and encouraging auditor mobility (dynamic teams);
- implementing professional standards and conducting periodic reviews (quality assurance).

Obstacles for the overconfidence effect mitigating measures are as follows:

- lack of knowledge (-sharing);
- lack of awareness (e.g., reasoning behind the implementation of a measure);
- inflexibility of people and resistance towards change;
- sluggish decision making within mixed and diverse teams;
- pressures on time and costs.

To conclude this section and answer the main research question the practical relevance and theoretical relevance of the results will be discussed, a reflection is given upon the end-results and finally, suggestions are given for further research.

### 7.1 Practical relevance

Overconfidence creates a mismatch between the IT auditors confidence in one’s own judgment and the real accuracy of these judgments. It affects the judgment of the IT auditor in:

- evaluation of evidence (e.g., does the evidence obtained provide sufficient appropriate audit evidence);
- estimating probabilities (e.g., determining whether probabilities are reasonable);
- deciding between options (e.g., choices related with audit procedures).

As of consequence IT auditor overconfidence could lead to:

- ineffective audits (misstatements) and legal problems;
- inappropriate staffing (unnecessary costs);
- inefficient use of technology, and misallocation of audit resources.

The aforementioned (desk research-based) theoretical consequences were validated in interviews with IT audit practitioners.
Both junior and senior IT auditors showed high levels of miscalibration. Moreover, a statistically significant difference was found between junior and senior IT auditors: juniors were less calibrated than seniors. The results of this study suggest that it would be wise for junior IT auditors to collaborate with their seniors.

There are no specific mitigating actions targeting the overconfidence effect. A model describing the key decision moments of an audit that can be affected by the overconfidence effect was devised and validated by IT audit practitioners. The key decision moments are related to: plan of approach (scoping, timelines, resources), work-program (risks, controls and test-steps), amount of fieldwork performed, reporting (inclusion/exclusion of the to-be reported observations and findings, and risk determinations (high/med./low). This model can be used as an awareness tool in order to mitigate the overconfidence effect. The results of this study can also be used as a means to increase awareness on this topic.

**7.2 Theoretical relevance, limitations and further research**

The results of this study contributes to the growing literature related to the overconfidence effect and provides evidence that IT auditors (seniority unspecified) are both overconfident and that there is difference between junior and senior IT auditors.

This study did not try to capture all aspects of overconfidence. There are good reasons to focus on miscalibration, nonetheless future research could focus on other aspects of the overconfidence effect.

Using non-auditing tasks has the advantage that results of the study are not exclusively accredited to the specificities of the research instrument. Using an auditing task would introduce the problem that there would be no control condition. Consequently, it would be difficult to know if the results would be driven by the specificities of the population, or by the specificities of the task (i.e. inducing bias somehow). However, future research could investigate whether the results of this study might be different when other measures or tasks are used.
The wisdom of the crowds needs to be researched further before it can be used by IT audit professionals to mitigate the overconfidence effect. Currently, many questions remain to be answered before this instrument can be used.

According to IT audit practitioners the decision diary will not help mitigate the effects of the overconfidence effect yet it may only be useful for reviewing purposes. Future research could focus on exploring the optimal way to use the decision diary for reviewing.

Self-reflection and audit team reflections have potential to mitigate the overconfidence effect. Reflection is more effective when auditors understand the necessity (awareness) and when there is an open working environment (culture). Based on this study (self-) reflection shows serious potential for further research, especially regarding on how it should be implemented to mitigate the overconfidence effect.

The generalizability of this research is limited to the Netherlands. It would be interesting to see in further research whether- and what kind of overconfidence effect(s) exist in other countries. Another generalizability limitation lies in the fact that IT auditing students of only two universities were part of this study. As such, further research can also be performed on students of several other studies.
References


# Appendix 1 – HITRATE tests

## Descriptive Statistics

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## Independent Samples Test

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Test Statistics\(^a\)

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\(^a\) Grouping Variable: StudRE
## Appendix 2 – INTERVALSIZE tests

### Descriptive Statistics

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### Mann-Whitney Test

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Appendix 3 – ERROR tests

Descriptive Statistics

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Mann-Whitney Test

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