Title
The use of substantive aggregate analytical procedures: do auditors particularly rely on nonsignificant outcomes?

Abstract
In order to find out whether auditors particularly rely on results of substantive analytical procedures which indicate no significant difference between the auditor’s expectation of recorded amounts and the book value, an experimental investigation was conducted. The findings show that auditors do rely on nonsignificant outcomes of substantive aggregate analytical procedures when assessing the likelihood of material misstatements. Although they overestimate the reliability of nonsignificant outcomes, they do not particularly rely on them. Instead, when adjusting the audit programme, their audit decisions are asymmetrical. Where outcomes are nonsignificant, they do not adjust the original proportion of tests of details, whereas they increase the proportion if the outcome is significant.

JEL classification: M41, M42.

Keywords: substantive analytical procedures, tests of details, audit evidence, audit.
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1 Introduction

Analytical audit procedures comprise the analysis of ratios and trends as well as the investigation of relationships which differ from expected amounts (cf. International Federation of Accountants (IFAC) 2010, International Standard on Auditing (ISA) 520.4). They are used during the audit of annual financial statements in the phases of audit planning and the overall (i.e. final auditor’s) review near the end of the audit (cf. Swiss Institute of Certified Accountants and Tax Consultants 2010, Swiss audit standard (PS) 520.2). During the audit, analytical procedures may replace or be used in combination with tests of details as substantive procedures (“substantive analytical procedures”), (cf. IFAC 2010, ISA 520.3).

Substantive analytical procedures are audit procedures which deliver sufficient and appropriate audit evidence to detect material misstatements (cf. IFAC 2010, ISA 520.7). Audit evidence obtained on the basis of analytical procedures, which are generally more efficient and cost-effective compared with tests of details (cf. Loebbecke/Steinbart 1987), is increasingly appropriate the more accurately the auditor’s expectation of recorded amounts is developed for a balance sheet item or item in the income statement (cf. Whittington 1990). Accordingly, when auditors develop an expected value it is essential to take into account the aggregation level (monthly or annual data) and reliability of the data (data prepared by an external organisation or the client), the effectiveness of the methods used (regression analysis or simple trend comparisons) and the predictability of the relevant relationships (items in the income statement or balance sheet items), (cf. Blocher/Patterson 1996). If, for example, the expected value is developed on the basis of monthly data, the audit evidence obtained from analytical procedures will be more persuasive than if the analytical procedures were based on quarterly or annual data.

The development of the auditor’s expectation of a recorded amount for an item in the annual financial statements is the starting point (cf. Koonce 1993; Hayes et al. 2005) as part of an analytical audit procedure, which represents a series of activities (cf. Kayadelen 2008). The expected value (target value) and the book value reported in the annual financial statements (actual value) are subsequently compared. If no significant difference is identified between the expected value and the book value, this can be used as audit evidence that the amount is consistent with the accounting standard of the amounts reported in the annual financial statements (cf. Marten et al. 2007). In this case, the auditor may decide to reduce the number of tests of details or dispense with these. However, if a significant difference is determined, there might be an error in the annual financial statement data. In that case, an extensive investigation is carried out, in order to determine the reason for the difference established (cf. IFAC 2010, ISA 520.7). The audit evidence obtained must be evaluated, in order to subsequently form an auditor’s opinion. The opinion will essentially depend on whether the reason for the difference is a misstatement in the annual financial statement data or, for example, changes in the sector environment or the company’s organisation (cf. Marten et al. 2007). The process for carrying out analytical procedures is illustrated below.
When performing analytical procedures the probability of material misstatements regarding specific items in annual financial statements is usually estimated, after comparing the expected value and the book value (cf. Blocher/Patterson 1996; Hayes et al. 2005). To ensure that the audit effectiveness and audit efficiency are not impaired, when the probability of a material misstatement is estimated, in addition to the results of the analytical procedure, it is also necessary to take into consideration the strength of the audit evidence obtained from the analytical procedure (cf. Brown/Solomon 1990; Lin et al. 2000). The same applies to revising the audit programme in terms of re-determining the proportion of tests of details. The estimated probability of material misstatements, the required evaluation of the strength of the audit evidence obtained from an analytical procedure on the basis of aggregated data and the re-definition of the proportion of tests of details in relation to substantive analytical procedures are the object of investigation of the present paper.

Although there is empirical evidence that analytical procedures based on disaggregated data are more effective (cf. Knechel 1988), in auditing practice, aggregate analytical procedures are often used (cf. Glover et al. 2005), for example because of the lack of possibilities for the client to process the data. Since the audit evidence obtained from aggregate analytical procedures is weak, no great reliance should be placed on the results of analytical procedures with a high aggregation level of the underlying data. However, the findings of the experiment by Glover et al. (2005) showed that auditors who established no significant difference between the value expected by the auditor and the book value as part of an aggregate analytical procedure estimated the probability of a material misstatement as being low, despite the fact that the audit evidence obtained was weak. At the same time, if auditors identified a significant difference as part of aggregate analytical procedures, they did not consider the probability of errors to be high, but instead only medium high. The authors concluded from this that auditors overestimate the strength of the audit evidence obtained from aggregate analytical procedures if they establish no significant difference. Accordingly, auditors rely particularly on nonsignificant outcomes of aggregate analytical procedures when judging the probability of errors.

These findings contradict the results of empirical studies on audit planning decisions. Biggs et al. (1988) observed for the first time the asymmetrical use of analytical audit procedures. The findings of their exploratory study suggested that auditors do not reduce the originally planned scope of tests of details if the result of an analytical audit procedure signals no
significant difference, whereas they expand the scope if the result of the analytical procedure indicates a significant difference. Consequently, auditors do not rely on nonsignificant outcomes of aggregate analytical procedures when making audit decisions.

As part of the present paper, the concurrent findings of the above and other empirical investigations are reviewed and analysed. The investigation is therefore aimed at making a contribution to answering the question of whether auditors particularly rely on audit evidence based on nonsignificant outcomes of aggregate analytical procedures. This raises the following sub-questions:

1. Do auditors judge the probability of errors to be significantly lower if, in the course of an aggregate analytical procedure, they establish no significant difference between the value expected by the auditor and the book value than when they identify a significant difference?

2. Do auditors overestimate the strength of audit evidence obtained from an aggregate analytical procedure if they establish no significant difference between the expected value and the book value?

3. Do auditors make asymmetrical audit decisions depending on the outcome of the aggregate analytical procedure when adjusting the audit programme in terms of non-adjustment if there is no or a negligible difference on the one hand and on the other, increasing the proportion of tests of details in the overall scope of substantive procedures if there is a significant difference?

This paper, for the first time, simultaneously analyses the evaluation of the strength of the audit evidence obtained from an aggregate analytical procedure and the asymmetrical use of analytical procedures. It is therefore possible to verify whether an asymmetrical use of analytical procedures can be observed, despite the fact that the strength of the audit evidence obtained from aggregate analytical procedures is overestimated.

To facilitate a response to this research question, an experiment-based investigation was conducted involving 75 auditors at a Swiss subsidiary of one of the Big 4 auditing firms. As part of an audit case study, they were asked to check the accuracy of the net interest income of a fictitious bank by means of an aggregate analytical procedure whilst auditing the financial statements with reasonable assurance (in Switzerland, the term used is *ordentliche Revision*). Analytical procedures were predominantly planned for the purpose of checking net interest income. Relying too heavily on nonsignificant outcomes of analytical procedures seriously impacts on the effectiveness of the audit if an item in the financial statements contains a material misstatement. For this reason, the net interest income figure comprised a material misstatement, which the result of the aggregate analytical procedure either highlighted (test condition 1) or failed to indicate (test condition 2). Participants estimated the probability of a misstatement. Furthermore, they evaluated the strength of the audit evidence obtained from the aggregate analytical procedure. After completing the analytical procedure, they also revised the proportion of tests of details in relation to substantive procedures.

The study was conducted in Switzerland, because analytical procedures have been gaining in importance there since the introduction of audits with limited assurance (in Switzerland, the term used is *eingeschränkte Revision*) on 1 January 2008. The audit with limited assurance is comparable to a review by an auditor and represents an innovative as well as pragmatic alternative for small and medium-sized enterprises (SME) to the audit of the financial statements which provides a sufficiently (high) level of audit assurance (Knecht 2008). To relieve the burden on SMEs in terms of high audit costs and time-consuming audits, the Swiss
Code of Obligations (OR) provides for audits with limited assurance, unlike audits with reasonable assurance, to be restricted to interviews, analytical procedures and appropriate tests of details (cf. Section 729a Sub-section 2 OR). However, the present study is equally relevant beyond Switzerland, as it can be assumed that analytical procedures will also become increasingly important within the European Union (EU). The European Commission is currently considering the introduction of an audit service specifically tailored to SMEs, which is limited in terms of audit assurance and as part of which analytical procedures would play a major role. In its Green Paper, the Commission makes express reference to Switzerland (cf. European Commission 2010).

This introduction is followed in the second section by a description of the state of the art in research and the development of hypotheses. The third section outlines the experiment conducted. The results are then presented in section 4. In the fifth section, the conclusions are described.

2 State of the art in research and development of hypotheses

2.1 Evaluation of the probability of a material misstatement

When evaluating the probability of a material misstatement, in addition to the outcome of the analytical procedure, it is necessary to consider the strength of the audit evidence obtained from the analytical procedure, so as not to impair the effectiveness and efficiency of the audit. The more accurate the auditor’s expectation of recorded amounts, the more persuasive is the audit evidence and the more reliable are the results of analytical procedures (cf. Whittington 1990; Kinney/McDaniel 1996). If the outcome of an analytical procedure signals no (a) significant difference between the expected value and the book value and the audit evidence obtained is of a high quality, the probability of errors can be deemed to be low (high). However, if the audit evidence is weak, a low (high) probability of errors should not be assumed, because there may actually be a (no) material misstatement (cf. Hayes et al. 2005; Kayadelen 2008). If the probability of errors is estimated to be low, despite the audit evidence obtained being weak, and an audited area which does not comply with the accounting standards is accepted as a consequence, the audit effectiveness would be jeopardised (cf. Wilson/Colbert 1991). In comparison, audit efficiency would be impaired if, regardless of weak audit evidence, the probability of errors were to be considered high and an audited area which meets the standards would be subject to an in-depth investigation.

In their experimental study, Lin et al. (2000) examined the extent to which the link between the results of analytical procedures and the evaluation of the probability of errors is impacted by the factors which determine the accuracy of the expected value and therefore the strength of the audit evidence, such as the reliability of the underlying data. The authors established that the results of analytical procedures had a significant impact on the evaluation of the probability of errors. At the same time, they observed no significant interaction effects between the results of analytical procedures and the factors which determine the strength of the audit evidence. Irrespective of the strength of the audit evidence obtained, the auditors taking part in the experimental study tended to assume a low probability of errors if they observed no significant difference in the course of analytical procedures, whereas they judged
the probability of errors not as high but only medium high if they established a significant difference as part of analytical procedures. It should be noted that the auditors considered the probability of errors to be low if there was no significant difference, despite the fact that the audit evidence obtained was weak. However, the auditors were of the opinion that rather than being high, the probability of errors was approximately medium high if they ascertained a significant difference and the quality of the audit evidence obtained was low.

The results of the study by Lin et al. (2000) were confirmed by the findings of the experimental study conducted by Glover et al. (2005), in which auditors carried out an aggregate analytical procedure. In the cases where the auditors taking part in this study established no significant difference, they assumed a low probability of errors (11.0%), although the quality of the audit evidence obtained was low. At the same time, they considered the probability of errors not to be high but approximately medium high (41.0%) if they identified a significant difference. Glover et al. (2005) therefore observed that the auditors judged the probability of errors to be considerably lower if the outcome of the aggregate analytical procedure signalled no significant difference than if it indicated a significant difference. However, in this context, i.e. for analytical procedures with a low degree of reliability, there should be no significant correlation between the outcome of analytical procedures and the evaluation of the probability of errors.

If auditors determine no significant difference in the course of analytical procedures, based on the above studies, they assume a low probability of errors. However, they tend to consider the probability of errors to be medium high if they identify a significant difference. Consequently, it is to be expected that auditors judge the probability of errors to be considerably lower where the outcome of analytical procedures is nonsignificant than where it indicates a significant difference. The following hypothesis is derived:

**Hypothesis 1:** Auditors who, in the course of aggregate analytical procedures, establish no significant difference between the expected value and book value, estimate the probability of a material misstatement to be considerably lower than auditors who identify a significant difference as part of the same aggregate audit procedure.

2.2 Evaluation of the strength of the audit evidence obtained

The explanations in the previous sections imply that critical evaluation of the strength of the audit evidence obtained from analytical procedures is important in forming a precise judgement of the probability of errors and taking appropriate audit decisions (cf. Blocher/Patterson 1996; Lin et al. 2000). For example, the quality of the audit evidence obtained must critically be evaluated when deciding on the acceptance of the audited area (cf. Marten et al. 2007), in order to prevent acceptance of an audited area which does not comply with accounting standards.

When judging the strength of the audit evidence obtained from analytical procedures, it is necessary to consider that the conclusiveness of the audit evidence depends on the accuracy of the expectation of recorded amounts which has been developed. In this respect, the strength of the audit evidence increases in line with the accuracy of the expected value (cf. Whittington 1990). If, for example, the expected value is developed on the basis of
aggregated data, the quality of the audit evidence obtained from an analytical procedure is to be considered low even if the outcome of the analytical procedure is nonsignificant. Consequently, there is no correlation between the outcome of analytical procedures and the strength of the audit evidence obtained (cf. McDaniel/Simmons 2007). Therefore, auditors should not be influenced by the outcome of analytical procedures when evaluating the strength of audit evidence, in order to avoid judging the audit evidence incorrectly which would possibly impair the effectiveness or efficiency of the audit. There is an apparent analogy with the evaluation of a decision. If there is a high level of uncertainty, even a careful decision may produce an unfavourable result. Consequently, no conclusions regarding its quality should be drawn on the basis of the result of a decision taken (cf. Brown et al. 1974; Mowen/Stone 1992). However, if the evaluation of a decision made is based on its outcome, this may result in a distorted assessment (outcome bias) (cf. Baron/Hershey 1988).

As described in the previous section, in their experimental study, Glover et al. (2005) observed that auditors who established no significant difference in the course of an aggregate analytical procedure, assumed a low probability of errors, despite the fact that the quality of the audit evidence obtained from the aggregate analytical procedure was low. On the other hand, they did not judge the probability of errors to be high if they identified a significant difference but rather as medium high. In this respect the authors pointed out that the causal link between the outcome of the aggregate analytical procedure and the estimated probability of errors may be explained by the different evaluation of the strength of the audit evidence obtained. They ascertained that the outcome of the aggregate analytical procedure had a considerable impact on the evaluation of the strength of the audit evidence obtained. The auditors judged the audit evidence as considerably stronger when the outcome was nonsignificant than when it signalled a significant difference (3.9 versus 2.9 on a scale of 1 to 7). Accordingly, auditors particularly rely on nonsignificant outcomes. However, the outcome of analytical procedures should not impact on the evaluation of the strength of the audit evidence obtained, so as not to jeopardise the effectiveness of the audit.

The fact that auditors particularly rely on nonsignificant outcomes is partly due to auditors’ expectation regarding the outcome of analytical procedures (cf. Bamber et al. 1997; Glover et al. 2005). Based on empirical-archival studies, auditors detect a relatively low number of material misstatements on average in each audit of annual financial statements. Therefore they possibly expect a nonsignificant outcome from analytical procedures which consequently indicates no potential material misstatement (cf. Hylas/Ashton 1982; Kreutzfeldt/Wallace 1986). If auditors identify a nonsignificant outcome which is therefore consistent with the result they expected, they may not be sufficiently critical in their evaluation of the reliability of the outcome and hence the strength of the audit evidence obtained, and this may result in their overestimating the strength of the audit evidence in view of the quality of the expectation which they developed in respect of recorded amounts. Socio-psychological studies and empirical studies from other scientific disciplines show that individuals make errors in their judgments. For example, they rate information obtained as more reliable if the information verifies their hypotheses than if it proves their hypotheses to be wrong (cf. Hastie 1984; Pyszczynski/Greenberg 1987; Schweizer 2007). Individuals whose expectations are confirmed are less critical in terms of questioning the reliability of evidence obtained than individuals whose hypotheses are disproved (cf. Lindenberg 2006).

Furthermore, the fact that auditors overestimate the strength of audit evidence is attributable to auditors’ preference regarding the outcome of analytical procedures (cf. Glover et al. 2005). It seems that auditors prefer a nonsignificant outcome, as the auditor may then take the decision not to perform an in-depth investigation (cf. IFAC 2010, ISA 520.7; Marten et al.
2007). If auditors establish a result which signals no significant difference and is therefore consistent with the desired outcome, they may not be sufficiently objective in their evaluation of the reliability of the outcome and therefore the strength of the audit evidence obtained, which may result in their overestimating the quality of the audit evidence in terms of the quality of the expectation they developed for the recorded amounts. In socio-psychological research, it has been demonstrated that individuals have a tendency to wishful thinking. For example, they consider results obtained to be more reliable if the results correspond to the desired outcome than if they are not consistent with their preferred results (cf. Kunda 1990). In this respect, individuals are less critical in their review of results obtained if the results are consistent with those they prefer than when they are not consistent with the desired results (cf. Sherman/Kunda 1989, quoted in Kunda 1990).

The above explanations suggest that auditors overestimate the strength of audit evidence if the outcome of analytical procedures is nonsignificant and therefore consistent with the anticipated or desired outcome. Similar to Glover et al. (2005), it is expected that auditors consider the audit evidence obtained from aggregate analytical procedures to be considerably stronger if the outcome is nonsignificant than when it signals a significant difference. This results in the following hypothesis:

**Hypothesis 2:** Auditors who, in the course of aggregate analytical procedures, establish no significant difference between the expected value and the book value estimate the audit evidence obtained from the analytical procedures to be considerably stronger than auditors who identify a significant difference as part of the same aggregate audit procedure.

2.3 Re-determination of the proportion of tests of details in relation to substantive procedures

If the proportion of tests of details in relation to substantive procedures is to be re-determined, this happens at the end of analytical procedures (cf. Fig. 1). In this respect, maintaining, reducing or increasing the originally planned proportion of tests of details in relation to substantive procedures represents an audit decision to be taken (cf. Marten et al. 2007).

As part of revising the audit programme in terms of re-determining the proportion of tests of details, in addition to the outcome of the analytical procedure, the strength of the audit evidence obtained from the analytical procedure must be taken into account, so as not to jeopardise the effectiveness and efficiency of the audit (cf. Loebbecke/Steinbart 1987; Brown/Solomon 1990).6

If, on the one hand, the outcome of an analytical procedure is nonsignificant and the audit evidence obtained is strong, the probability of errors can be considered to be low and the proportion of tests of details in relation to substantive procedures may be reduced (cf. Lin et al. 2000; Marten et al. 2007; Arens et al. 2010). In the event of weak audit evidence, however, it a low probability of errors should not be assumed, because there may actually be a material misstatement (cf. Kayadelen 2008). Therefore, the proportion of tests of details in relation to substantive procedures should not be reduced until a minor deviation ascertained has been confirmed by the result of a further analytical procedure, which delivers stronger audit evidence. If the proportion of tests of details is gradually reduced, despite the fact that only weak audit evidence was obtained, or if tests of details – on the basis of which a material
misstatement is more likely to be detected than by means of aggregate analytical procedures – are entirely dispensed with, where applicable, the effectiveness of the audit may be impaired.

In so far as, on the other hand, the results of analytical procedures demonstrate a significant difference and the quality of the audit evidence obtained is high, it can be assumed that the probability of errors is high and it is necessary to increase the proportion of tests of details, although a significant difference identified must be subject to an in-depth investigation ahead of any audit decision to be taken (cf. Lin et al. 2000; Knechel et al. 2007; IFAC 2010, ISA 520.7). If the conclusiveness of the audit evidence obtained is low, however, it cannot be assumed that the probability of errors is high, since there may not be a material misstatement (cf. Hayes et al. 2005). Accordingly, increasing the proportion of tests of details should not be regarded as necessary until the significant difference identified is confirmed by the result of an additional analytical procedure, on the basis of which stronger audit evidence is obtained. If an audited area is subject to an in-depth investigation, despite the audit evidence obtained being weak, and increased use is made of tests of details, the efficiency of the audit may be impaired (cf. Wilson/Colbert 1991; Marten et al. 2007).

Glover et al. (2005) observed that the auditors who took part in their experimental study overestimated (did not overestimate) the strength of audit evidence obtained on the basis of aggregate analytical procedures if the results signalled no (a) significant difference. It can therefore be assumed that auditors who establish no significant difference in the course of aggregate analytical procedures will considerably reduce the proportion of tests of details in relation to substantive procedures, despite obtaining only weak audit evidence, whereas auditors who identify a significant difference do not adjust the proportion of tests of details in view of the low degree of conclusiveness of the audit evidence. Although such use of aggregate analytical procedures represents no threat to audit efficiency, it potentially jeopardises audit effectiveness (cf. Quick 1999).

However, the findings of Glover et al. (2005) contradict the results of empirical studies on audit planning decisions. Biggs et al. (1988) for the first time observed the asymmetrical use of analytical procedures. The auditors taking part in their explorative study did not reduce the originally planned scope of tests of details if the outcome of analytical procedures was nonsignificant, whereas they increased the scope if the results signalled a significant difference. Of the 422 changes implemented by the auditors, 19 represented a reduction of and 403 an increase in the scope of the audit. Since Biggs et al. (1988) only analysed the audit decisions of four auditors, Cohen and Kida (1989) examined whether an asymmetrical use of analytical procedures could also be ascertained in a greater number of auditors. In their experimental study involving 96 auditors, they observed that the auditors made no significant adjustments to the number of hours planned for carrying out tests of details if the control risk was low (nonsignificant increase from 47.0 to 51.7) and if they established no significant difference in the course of analytical procedures. However, they substantially increased the number of hours (from 47.0 to 59.9) if they identified a significant difference. Cohen und Kida (1989) were able to confirm that auditors use the outcome of analytical procedures solely as an indicator of audit risks. In so doing, the authors attributed the one-sided use of analytical procedures to the professional training courses required, which promote conservative decision-making.

The one-sided use of analytical procedures was also observed by Bédard (1989) in her empirical-archival study. The author examined a selection of working papers relating to completed audits and discovered that changes to audit programmes made as a result of the outcome of analytical procedures solely represented increases to the scope of the audit.
author referred to asymmetrical reliance on the results of analytical procedures. Auditors do not rely on nonsignificant outcomes, whereas they rely on results that indicate a significant difference. Although this asymmetrical reliance implies no threat to the effectiveness of the audit, it jeopardises the efficiency of the audit.

Audit decisions resulting from the outcome of analytical procedures have also been analysed by means of questionnaire-based surveys. Fraser et al. (1997) stated in contrast with the findings of the above-mentioned empirical studies that the majority of the 366 auditors taking part in their survey would reduce the scope of tests of details if the outcome of analytical procedures was nonsignificant. The basic willingness to reduce the scope of tests of details was confirmed by the questionnaire-based study of Mulligan and Inkster (1999), in which 307 auditors took part. 29.0% (35.0%) of the auditors indicated that they always (frequently) reduce the scope if the outcome of analytical procedures is nonsignificant. However, 31.0% (28.0%) of the respondents always (often) obtain confirmation of the outcome of analytical procedures by means of the results of further audit procedures before reducing the scope of tests of details. Lin and Fraser (2003) evaluated the questionnaires returned by 182 auditors and found that 37.4% of the respondents would reduce the scope of tests of details on the basis of the outcome of analytical procedures without carrying out further audit procedures. Conversely, 50.5% of the auditors would only reduce the scope after the outcome of analytical procedures had been confirmed by the results of additional audit procedures. The remaining 12.1% of auditors stated that they never reduce the scope of tests of details even if the outcome of analytical procedures is nonsignificant. In view of these findings, Lin and Fraser (2003) concluded that auditors lack confidence in nonsignificant outcomes of analytical procedures.

The studies on audit planning decisions made on the basis of the outcome of analytical procedures overwhelmingly point to an asymmetrical use of audit procedures. Consequently, the expectation is that auditors do not adjust the originally planned proportion of tests of details in relation to substantive procedures if the outcome of aggregate analytical procedures is nonsignificant, whereas they substantially increase the proportion if the outcome indicates a significant difference. This results in the following hypothesis:

**Hypothesis 3:** Auditors who, in the course of aggregate analytical procedures, establish no significant difference between the expected value and the book value do not adjust the originally planned proportion of tests of details in relation to substantive procedures, whereas auditors who identify a significant difference as part of the same aggregate audit procedure substantially increase the proportion.

### 3 Experiment

#### 3.1 Participants

A total of 75 assistants of a Swiss subsidiary of one of the Big4 firms of auditors participated in the experiment. The assistants were suitable candidates for participating in the survey,
because they are familiar with carrying out analytical investigations in the form of substantive procedures (cf. Hirst/Koonce 1996). Although in audit research participants often are not assistants but in senior or management positions instead (cf. Glover et al. 2005; McDaniel/Simmons 2007), selecting assistants at a Swiss subsidiary was an ideal solution. The implementation of the audit with limited assurance creates the problem in auditing practice of whether or how assistant auditors can be instructed to carry out analytical procedures. On the one hand, using assistant auditors helps to respond to cost pressure. On the other hand, analytical procedures rely heavily on audit experience and professional judgement. This makes it even more important to analyse the assistant auditors’ evaluation of the probability of errors, their judgement of the strength of the audit evidence obtained and their audit decisions. Based on the results, conclusions are drawn regarding the extent to which assistants can already be tasked today with carrying out analytical procedures or how in-house training courses at companies need to be adapted, in order to make it possible to task a rising number of assistants with carrying out analytical procedures.

Due to the lack of or unclear information in connection with the evaluation of the probability of errors, the judgement of the strength of the audit evidence obtained from aggregate analytical procedures and the re-determined proportion of tests of details in relation to substantive procedures, the data for five participants has been disregarded in the data analysis. For the statistical data analysis, the data from 70 participants remained. Their demographic characteristics are summarised in Table 1.

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### 3.2 Tasks and questions

Participants were randomly divided into two groups of approximately the same size. The participants in both groups were given a case study on the audit of financial statements with reasonable level of assurance\(^8\), as part of which they were asked to carry out an analytical procedure to evaluate the accuracy of the amount of net interest income from loans. The only difference in the case study was that if the calculation of the analytical procedure was correct, the outcome was nonsignificant in one group whereas a significant difference was indicated in the other group.

The participants were asked to evaluate the plausibility of the net interest income from loans of a fictitious bank whose loan portfolio mainly consisted of agricultural, commercial and real estate loans as well as loans to individuals. A misstatement of CHF 112 million, or 4.2% of
net profit for the year, was considered to be material. The participants were told that the inherent risk in the interest income item was classified as low and that the control risk was categorised as low due to test of controls in the credit business. In addition, participants were made aware that the mix of analytical procedures and tests of details was 75%:25%. For checking net interest income, analytical procedures and tests of details were therefore envisaged, with mainly analytical procedures planned. Furthermore, participants were informed that the team of auditors had developed an expectation of the amount recorded for net interest income in the previous year by multiplying the average loan volume by the weighted average annual interest rate. In this context, it was pointed out to participants that proper reporting of the average loan portfolio was ensured on the basis of adequate audit evidence and that the interest rates used to calculate the weighted average annual interest rate were comparable to the interest rates published in a bank report by the Swiss National Bank. The previous year’s calculations were illustrated. The difference established between the expected value developed and the reported net interest income was classified as nonsignificant.

After reading the background information about the fictitious bank, participants were asked to check the accuracy of the amount of net interest income from loans by applying the same analytical procedure as in the previous year. The figures for the aggregated loan volume of the current financial year and that of the previous year as well as the weighted average annual interest rate were made available to participants. Having carried out the aggregate analytical procedure, the participants answered the question regarding their evaluation of the probability that the reported net interest income was materially misstated. They were also asked to judge the strength of the audit evidence obtained from the aggregate analytical procedure. In addition, immediately after completing the analytical procedure, they were requested to re-determine the mix of analytical procedures and tests of details, or specify the proportion of tests of details in relation to substantive procedures.

3.3 Variables

3.3.1 Independent variable

The result of the aggregate analytical procedure represents the independent variable “result”. In the course of the aggregate analytical procedure, half of the participants established no significant difference between the expected value and the reported book value (CHF 21 million), whereas the other half identified a significant difference as part of the same audit procedure (CHF 148 million). The targeted manipulation of the test condition facilitated an analysis of the impact of the outcome of the aggregate analytical procedure on the evaluation of the probability of errors and the judgement of the strength of the audit evidence obtained from the aggregate analytical procedure. Furthermore, it was possible to examine whether participants used the aggregate analytical procedure asymmetrically when re-determining the proportion of tests of details in relation to substantive procedures.
3.3.2 Dependent variables

The first dependent variable is participants’ evaluation of the probability of a material misstatement. Participants judged the probability of errors on a scale of 0% (“not at all misstated”) to 100% (“definitely misstated”). The second dependent variable is participants’ judgement of the strength of the audit evidence obtained from the aggregate analytical procedure. Participants judged the strength on a scale of 1 (“extremely weak”) to 7 (“extremely strong”). The third dependent variable is the re-determined proportion of tests of details in relation to substantive procedures specified by participants following the aggregate analytical procedure. The new definition of the scope was based on a scale of 0% to 100%. Ameen and Strawser (1994) as well as Mulligan and Inkster (1999) used comparable scales. It should be noted that participants determined the proportion of tests of details when specifying the new mix of analytical procedures and tests of details. The new proportion of tests of details in relation to substantive procedures they determined was used as the dependent variable to verify hypothesis 3.

3.4 Process

The experiment was conducted in a seminar room as part of a one-week training course. First, participants were randomly assigned to one of the two test conditions. Before opening the envelopes they had been handed, which contained the sheet with background information about the fictitious bank, the tasks and questions as well as a sheet with demographic questions, participants received the necessary instructions for working on the particular case. One of the instructions given to participants was not to solve the case study in groups but independently of each other. Once they had received the instructions, they worked on the case study. After completing work on the case study, participants answered demographic questions. Following completion of the experiment, they were informed of its purpose.

4 Results

4.1 Evaluation of the probability of a material misstatement

To verify hypothesis 1, an independent t-test was carried out. In this context, the independent variable “result” represented the grouping variable. Participants’ evaluation of the probability of a material misstatement represented the dependent variable. The calculated mean cell values and standard deviations (cf. Panel A) as well as the result of the independent t-test (cf. Panel B) are shown in Table 2.
Table 2: Estimated probability of a material misstatement

<table>
<thead>
<tr>
<th>Panel A: Mean cell values (standard deviation in brackets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result</td>
</tr>
<tr>
<td>No significant difference</td>
</tr>
<tr>
<td>17.2% (9.1%) n = 36</td>
</tr>
<tr>
<td>Significant difference</td>
</tr>
<tr>
<td>45.1% (31.5%) n = 34</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Result of the independent t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta mean value df t p</td>
</tr>
<tr>
<td>27.9% 68 5.10 0.000</td>
</tr>
</tbody>
</table>

* The reported p value is one-sided.

Hypothesis 1 claims that auditors who establish no significant difference between the expected value and the book value in the course of aggregate analytical procedures judge the probability of a material misstatement to be considerably lower than auditors who identify a significant difference as part of the same audit procedure. Table 2 illustrates that participants who established no significant difference in the aggregate analytical procedure judged the probability of errors as considerably lower than participants who ascertained a significant difference using the same audit procedure (17.2% versus 45.1%; t(68) = 5.10, p < 0.001). These results therefore support hypothesis 1.

4.2 Judgement of strength of the audit evidence obtained

An independent t-test was carried out, in order to facilitate a decision as to whether hypothesis 2 can be upheld. The independent variable “result” represents the grouping variable. Participants’ evaluation of the strength of the audit evidence obtained from the aggregate analytical procedure is the dependent variable. The mean cell values and standard deviations which emerged (cf. Panel A) as well as the results of the independent t-test (cf. Panel B) are shown in Table 3.

Table 3: Evaluation of the strength of the audit evidence obtained

<table>
<thead>
<tr>
<th>Panel A: Mean cell values (standard deviation in brackets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result</td>
</tr>
<tr>
<td>No significant difference</td>
</tr>
<tr>
<td>4.43 (1.09) n = 36</td>
</tr>
<tr>
<td>Significant difference</td>
</tr>
<tr>
<td>3.55 (1.24) n = 34</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Result of the independent t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta mean value df t p</td>
</tr>
<tr>
<td>0.88 68 3.14 0.001</td>
</tr>
</tbody>
</table>

* The reported p value is one-sided.

Hypothesis 2 states that auditors who establish no significant difference between the expected value and the book value in the course of aggregate analytical procedures judge the audit evidence obtained from the analytical procedure as considerably stronger than auditors who identify a significant difference as part of the same audit procedure. Table 3 highlights that
participants who established no significant difference in the aggregate analytical procedure judged the audit evidence obtained as considerably stronger than participants who established a significant difference as part of the same audit procedure (4.43 versus 3.55; $t(68) = 3.14$, $p < 0.01$). The null hypothesis must therefore be discarded.

4.3 Re-determined proportion of tests of details in relation to substantive procedures

One-sample t-tests were carried out to verify hypothesis 3. The re-determined proportion of tests of details in relation to substantive procedures specified by participants as a result of the aggregate analytical procedure represents the dependent variable. The test value is the proportion of tests of details in relation to substantive procedures originally planned of 25% (cf. section 3.2). The calculated mean cell values and standard deviations as well as the result of the one-sample t-tests are shown in Table 4.

<table>
<thead>
<tr>
<th>Result</th>
<th>Mean cell values (standard deviations in brackets)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>No significant difference</td>
<td>28.5% (17.6%)</td>
<td>36</td>
</tr>
<tr>
<td>Significant difference</td>
<td>52.5% (20.7%)</td>
<td>34</td>
</tr>
</tbody>
</table>

* No significant deviation from 25% ($t(35) = 1.18$, $p = 0.24$).
** Significantly higher than 25% ($t(33) = 7.77$, $p < 0.001$).

Hypothesis 3 states that auditors who establish no significant difference between the expected value and the book value in the course of aggregate analytical procedures do not adjust the proportion of tests of details in relation to substantive procedures originally planned, whereas auditors who identify a significant difference as part of the same audit procedure considerably increase the proportion. Table 4 highlights that participants who established no significant difference in the aggregate analytical procedure, specified a proportion of tests of details of 28.5% on average, whereas participants who established a significant difference in the same audit procedure specified a share of 52.5% on average. The re-determined proportion of tests of details specified by participants of 28.5% does not deviate significantly from the originally planned share of 25% ($t(35) = 1.18$, $p = 0.24$). Conversely, the re-determined proportion of 52.5% specified by participants is significantly higher than the originally planned share of 25% ($t(33) = 7.77$, $p < 0.001$). Consequently, participants who established no significant difference in the course of the aggregate analytical procedure did not adjust the originally planned proportion of tests of details in relation to substantive procedures. At the same time, participants who identified a significant difference as part of the same audit procedure considerably increased the proportion. As a result, hypothesis 3 is supported by the empirical findings.
5 Conclusions

To ascertain whether auditors particularly rely on nonsignificant outcomes of aggregate analytical procedures, an experimental study was conducted involving auditors from one of the Big4 auditing companies.

The experiment showed that if auditors establish no significant difference between the value they expect and the book value in the course of aggregate analytical procedures, they assume a low probability of errors, although the quality of the audit evidence obtained from the aggregate analytical procedure is low. However, if they identify a significant difference, they consider the probability of errors to be medium high. In this context, it was possible to prove that if auditors establish no significant difference in the course of aggregate analytical procedures, they overestimate the strength of the audit evidence obtained from the aggregate analytical procedures. As far as making audit decisions is concerned, the results of the experiment highlight that if auditors establish no significant difference in aggregate analytical procedures, they do not adjust the originally planned proportion of tests of details in relation to substantive procedures. If, in contrast, they identify a significant difference, they considerably increase that proportion.

The results suggest that auditors rely on nonsignificant outcomes of aggregate analytical procedures when evaluating the probability of errors. Although they overestimate the reliability of these results, they do not particularly rely on them when making audit decisions. Auditors have a tendency to take conservative decisions in favour of the effectiveness of the audit.

If auditors establish no significant difference in the course of aggregate analytical procedures, they overestimate the strength of the audit evidence obtained from the aggregate analytical procedure and consider the probability of errors to be low. This jeopardises the effectiveness of the audit. By combining analytical procedures and tests of details in the audit of an annual financial statements’ account, it is possible to prevent the impairment of audit effectiveness. Auditors do not reduce the originally planned proportion of tests of details in relation to substantive procedures, although they overestimate the strength of the audit evidence obtained from aggregate analytical procedures. However, where the audit of a specific item in the annual financial statements is to be based solely on analytical audit procedures, the strength of the audit evidence obtained from the analytical audit procedures must be evaluated critically. This can be achieved by providing specific in-house training and advanced training programmes in firms of auditors and taking into account checklists when evaluating the strength of the audit evidence obtained from analytical procedures (cf. Clarkson et al. 2002; Glover et al. 2005). In addition, the audit evidence obtained from analytical procedures could be evaluated prior to comparing the expected value for a specific item in the annual financial statements with the reported book value, in order to prevent the resultant nonsignificant outcome from distorting the evaluation. Furthermore, standard setters could point out that the strength of audit evidence obtained from analytical procedures must be evaluated critically even if the difference between the expected value and the book value is not significant.

The results of the experimental study are subject to limitations. Firstly, participants in the experiment were not randomly selected from the population of auditors. Secondly, external validity was limited due to the test situation created (simplified presentation of auditing practice, for example no possibility of working together with others involved in the investigation, no time or client pressure and no documentation requirement). Thirdly, all
participants were auditors at one of the Big4 auditing firms. Finally, transparency and the practical relevance of the tasks and questions may have been affected, because the case study assumed a structured approach when working on them.

With regard to future research, a similar experiment with even more experienced auditors (managers and/or partners) is recommended. As part of such a study, it would be possible to examine whether the results of the present study are confirmed. In connection with audit decisions, this experiment analysed whether auditors adjust the originally planned proportion of tests of details in relation to substantive procedures, depending on the outcome of aggregate analytical procedures. The auditors were not given the results of the audit programme with the planned audit procedures. Related studies could investigate, on the basis of the results of the audit programme, the extent to which auditors adjust the procedures for obtaining further audit evidence or the sample size, depending on the outcome of aggregate analytical procedures, in order to enhance external validity.

1 For the purposes of this paper, aggregate (detailed) analytical audit procedures comprise analytical audit procedures in the course of which the expected value is developed on the basis of aggregated (disaggregated) data.

2 With regard to the definition of the term “conclusiveness of audit evidence”, reference is made to the definition used by Gronewold (2006, p. 8): conclusiveness is “the contribution of one or more pieces of evidence to corroborate or disprove a hypothesis regarding reality to be checked, in particular the suitability and/or contribution of the evidence to establishing whether or not doubtful facts are applicable, which can no longer be observed directly.”

3 Lin et al. (2000) provide no comparable reference. They argue that auditors use the results of analytical procedures solely as indicators of potential audit risks when they evaluate the probability of errors.

4 This outcome provides an explanation for the result of the empirical-archival study conducted by the Public Oversight Board (2000), in which the working papers of completed audits were analysed. The study reveals that auditors often accept an audited area, although the analytical procedures performed fail to deliver the required audit assurance.

5 Glover et al. (2005) questioned 68 auditors as to whether they were more likely to identify no or a significant difference between the expected value and book value in the course of analytical procedures. Of the auditors surveyed, 56 stated that they would establish a nonsignificant outcome, with only nine auditors responding that they would identify a significant deviation. The remaining answers were not usable. This expectation on the part of auditors appears to occur, irrespective of the fact that when differences are established they are generally significant, i.e. they may range from being two to eight times greater than the previously specified materiality limit (cf. Kenny/Martin 1994; Ruhnke 2009).

6 In the course of the audit of annual financial statements, the assessment of inherent risk and control risk may change. This may result in an adjustment to the originally planned scope of tests of details (cf. IFAC 2010, ISA 330.25-27).

7 Lin et al. (2000) provided further proof of the asymmetrical use of analytical audit procedures. They observed that auditors taking part in their experimental study gave the
highest weighting to the predictability of developments regarding the relevant area audited and not the outcome of analytical audit procedures when they budgeted for the hours required to implement tests of details.

Although analytical audit procedures are becoming increasingly important, particularly following the introduction of the audit with limited assurance in Switzerland, the simulation used in the case study is the audit of financial statements with reasonable assurance rather than a audit with limited assurance, because the findings of the present study are intended to be comparable to those of earlier studies, which were the motivation for conducting the present study, e.g. Glover et al. (2005) and Biggs et al. (1988). Furthermore, the conclusions drawn and implications highlighted are to be of importance beyond Switzerland.

Irrespective of the assessment of inherent risk and control risk, certain substantive procedures must be performed for each significant class of transactions, balance sheet items and disclosures (cf. IFAC 2010, ISA 330.18).

To reduce the detection risk, it may be appropriate to rely more heavily on analytical audit procedures than tests of details with regard to assertions made in annual financial statements if internal controls are stringent (cf. IFAC 2010, ISA 520.5a). However, it is recommended that auditors avoid relying solely on analytical procedures in their conclusions on each significant class of transactions, balance sheet items and disclosures (Swiss Institute of Certified Accountants and Tax Consultants 2010, PS 520.15).

As part of their questionnaire-based studies, Ameen and Strawser (1994) as well as Mulligan and Inkster (1999) found that auditors would primarily plan analytical procedures for checking an item in the annual financial statements if internal controls were reliable. However, they would not dispense with tests of details, although relying solely on analytical audit procedures is conceivable if strong internal controls are in place (cf. IFAC 2010, ISA 520.18).

This type of analytical audit procedure is a plausibility test (cf. Colbert 1994). Analytical audit procedures may be implemented according to various methods (cf. IFAC 2010, ISA 520.4). Alongside the plausibility test, other frequently used and often cited methods include trend, ratio and regression analysis (cf. Mancuso 1992). However, the use of plausibility tests and regression analysis is recommended, because these methods are considered to be effective in terms of detecting material misstatements (cf. Blocher/Patterson 1996).

The fictitious client is a financial institution. However, as is evident from the explanations, no sector-specific experience is required to be able to work on the case study, since the tasks and questions are not of a complex nature. Furthermore, the judgement of the plausibility is comparable to that used for goods produced, where, for example, the number of units produced is multiplied by the cost of acquisition or production per unit (cf. Marten et al. 2007).

It should be noted that if the expected value is developed on the basis of aggregated data, the strength of the audit evidence obtained from the analytical procedure is low.

The case study is based on the case of Glover et al. (2005), the adaption of which was approved by S. Glover in his e-mail dated 9 October 2009. During a seminar at a Swiss subsidiary of one of the Big4 firms of auditors, a pilot was conducted with a manager and a partner, in order to check the comprehensibility and relevance of the tasks and questions of the adapted case study.
The sample variances differ significantly ($F(1, 68) = 48.80, p < 0.001$). However, if sample sizes are approximately equal, as applicable in the present case, the impact of heterogeneous sampling variances on the t-test is negligible (cf. Bortz/Schuster 2010).

The allocation of the re-determined proportion of tests of details specified by these participants differ significantly from normal distribution ($Kolmogorov-Smirnov z(36) = 1.64, p < 0.01$). However, since $n > 30$ applies to the sample, the normal distribution assumption can be deemed to be approximately fulfilled (cf. Bortz/Schuster 2010).
Bibliography


Schweizer M (2007) Bestätigungsfehler – oder wir hören nur, was wir hören wollen (Errors in audit opinions – or we only hear what we want to hear). http://www.decisions.ch/publikationen/confirmation_bias.html, accessed on: 22 April 2011


Appendix: Case study

Swiss Banking Corporation
Background Information

In February 2009 you are asked to evaluate the reasonableness of Swiss Banking Corporation’s interest income from loans for the year ended 2008. Total interest income for 2008 is CHF 5,425 million and net income for Swiss Banking Corporation (SBC) is CHF 2,680 million. A misstatement of CHF 112 million is considered material for this area.

SBC has banking operations in all cantons of Switzerland. Headquarters for the bank are in Zurich. SBC’s loan portfolio consists primarily of agricultural loans, commercial loans, real estate loans and loans to individuals. Credit granting authority is primarily centralized in Zurich. However, certain experienced loan officers have decision authority for small loans in their local area. Loan portfolio performance monitoring and ongoing credit quality assessments are performed in Zurich for all loans. The accounting processes for SBC are centralized in Zurich.

The inherent risk of the position interest income is classified as low. According to tests of controls in the credit business the reliability of controls is assessed as high and the control risk as low. According to a first evaluation the mix of analytical procedures and test of details is 75%:25%.

Last year’s audit: In addition to comparing the 2007 interest income to 2006 interest income, the audit team also developed an expectation for loan interest income using the average loan volume multiplied by the weighted average interest rate. Last year’s file indicates that the average loan volume agrees to numbers tested elsewhere in the audit file and that the interest rates used to compute the weighted average interest rates were comparable to those reported in a publication of the Swiss National Bank. The computation performed last year is provided below:

<table>
<thead>
<tr>
<th>Loan Interest Analytics 2007 (in millions CHF)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average loan volume 2007 (balance)</td>
<td>90,306</td>
</tr>
<tr>
<td>Multiplied by weighted average annual interest rate</td>
<td>5.3%</td>
</tr>
<tr>
<td>Expected loan interest income 2007</td>
<td>4,786</td>
</tr>
<tr>
<td>2007 loan interest income per SBC</td>
<td>4,830</td>
</tr>
<tr>
<td>Difference</td>
<td>44</td>
</tr>
</tbody>
</table>

The above stated difference of CHF 44 million was not considered material.
### Analytical Procedures

The following information is readily available for this year’s analysis (in millions CHF):

<table>
<thead>
<tr>
<th>Information</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate loan volume (balance) 12/31/2007</td>
<td>97,000</td>
</tr>
<tr>
<td>Aggregate loan volume (balance) 12/31/2008</td>
<td>96,000</td>
</tr>
<tr>
<td>Weighted average annual interest rate</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

Using the same analytical procedure that was used last year (average loan volume by weighted average annual interest rate), please determine if the interest income from loans reported at 12/31/2008 appears fairly stated and then answer the questions below:

1. Based on the results of the analytical procedure, how likely do you think it is that 2008 loan interest income is materially misstated?

   ![Likelihood Scale]

   - not at all misstated
   - definitely misstated

2. Please indicate on the scale below the strength (quality and sufficiency) of evidence provided by the analytical procedure:

   ![Strength Scale]

   - extremely weak
   - extremely strong

3. After having performed the analytical procedure, please indicate on the scale below your reevaluation of the mix of analytical procedures and test of details (one cross sufficient):

   ![Reevaluation Scale]

   - Analytical Procedures
   - Test of details
Demographic data

- Sex:
  - O male
  - O female

- Age:
  -

- Education:
  - O University
  - O University of applied sciences
  - O Other higher education
  - O Other: _________________

- Audit experience in years:
  -

- Level:
  - O Assistant
  - O Senior Manager
  - O Senior
  - O Partner
  - O Manager

- Sector:
  - O Financial Services
  - O Industries

Concluding questions

- How clear are the tasks and questions of the case study in your opinion?

  not at all clear
  completely clear

  1 2 3 4 5 6 7

- How relevant are the tasks and questions of the case study in your opinion?

  extremely low relevance
  extremely high relevance

  1 2 3 4 5 6 7
Participants who solved above case study established no significant difference between the expected value and the book value in the course of the aggregate analytical procedure. The other participants received manipulated financial information for establishing a significant difference. Despite of this information outlined below, all participants received the same information.

**Analytical Procedures**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate loan volume (balance) 12/31/2007</td>
<td>96,000</td>
</tr>
<tr>
<td>Aggregate loan volume (balance) 12/31/2008</td>
<td>95,900</td>
</tr>
<tr>
<td>Weighted average annual interest rate</td>
<td>5.5%</td>
</tr>
</tbody>
</table>