

**THE RELATIONSHIP OF RISK ASSESSMENTS AND
INFORMATION TECHNOLOGY TO DETECTED MISSTATEMENTS**

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ABSTRACT

In this paper we empirically examine the relationship of (1) risk assessments and (2) the extent of computerization of accounting systems to the incidence and magnitude of misstatements. The six largest public accounting firms in Norway provided misstatement data from 58 audits. The results show that inherent risk factors related to personnel issues are related to the incidence of misstatements at the financial statement level. These factors plus factors related to management integrity and prior period accounting adjustments are related to the magnitude of the misstatements. Inherent risk assessments at the account level had a marginally significant relationship with both the incidence and magnitude of the detected misstatements. On the contrary, we find that the auditors' CR assessments are not associated with the detected misstatements. All of the sample companies have partial or completely computerized accounting systems. Significantly more misstatements occurred in partially computerized companies due to inadequate segregation of duties and auditor disagreement with management's judgments. The client's internal control system failed to detect more misstatements in partially computerized systems because appropriate controls were missing or not properly applied. Finally, the magnitude of misstatements in a complex EDP environment were less than those in a non-complex environment.

Keywords: Inherent risk, control risk, misstatements

Data Availability: Data is available from the authors upon request.

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I. INTRODUCTION

For more than 20 years, audit practice has been guided by a risk-based approach in which the nature, timing, and extent of testing is determined by assessing the risk that financial statement assertions are materially misstated (Cushing et al. 1995). An assumption underlying this risk-based audit approach is that the presence of certain types of risk factors is indicative of possible misstatements in the client's accounts. Following a risk-based approach requires the auditor to assess the risks that are likely to lead to material misstatements, and then conduct audit procedures based on those assessments to determine if misstatements have occurred. Thus, the accuracy of the auditor's risk assessments can directly affect the effectiveness and efficiency of an audit. Throughout the 1980s, a number of studies examined archival data to determine the relationship of auditors' risk assessments to detected misstatements.¹

The last decade has seen tremendous growth in information technology (Elliott 1994). Most mid- to large-size companies have automated their accounting and information systems. Automated systems (e.g., enterprise resource programs) have built-in controls that should limit the occurrence of errors in routine transactions. During the same period, internal auditing functions have improved their control and monitoring activities; thus, providing better prevention and detection of misstatements. At the same time, the need for accounting estimates has increased and become more important in financial statement reporting and disclosure. Houghton and Fogarty (1991) report that many of the misstatements detected in their sample of audits were due to non-routine (e.g., estimates) transactions. Recently, Kinney (2000) noted that such

¹ See Eilifsen and Messier (2000) for a detailed review of this line of research.

changes are likely to alter the error generation process. As a result, the preaudit account balances and the probability of material misstatement have substantially changed.

These factors (increased use of information technology, improved internal auditing functions, and increased use of estimates) and their possible effects on the error generation process suggest that it is imperative for audit researchers to reexamine risk assessments and their relationship to detected misstatements. This paper empirically examines two issues. First, we test whether auditors' inherent risk (IR) and control risk (CR) assessments are related to the incidence and magnitude of misstatements as suggested by the audit risk model. The reliability of the assumption that IR and CR assessments are indicative of accounts that contain misstatements has both effectiveness and efficiency implications for auditors. Eilifsen and Messier (2000) note that research findings on the relationship of auditors' assessments of IR and CR to detected misstatements are mixed. Additionally, archival research by Mock and Wright (1993, 1999) suggests that audit plans may not be "risk-adjusted;" that is, auditors' planned audit procedures do not appear to be responsive to identified client risks.² This may affect the error detection process. Second, we examine how the extent of computerization of accounting systems relates to the incidence and magnitude of misstatements. The Bell et al. (1998) study is the only research that investigated this issue. However, their data came from 1989 audits and many of their sampled companies did not have computerized accounting systems. We use a more recent set of data; i.e., data more representative of current information technology environments.

² The results reported in their later paper show a greater, albeit limited, responsiveness of audit plans to client risks than prior research.

Our data is drawn from a sample of 58 Norwegian audits with 1997 year-ends. Our data are novel in a number of respects. First, we gather ratings of inherent risk factors at the engagement level, and assessments of IR and CR at the account level. Most prior studies collected this data at one level only. Second, our data comes from six audit firms. Prior studies have typically included sample data from only one Big 8 (6) firm.³ Finally, the current study examines misstatements detected for audit engagements with a 1997 year-end. To our knowledge, there is only one other data set that reports on auditor-detected misstatements in the 1990s (Chan and Mo 1998), and those researchers focused mainly on the distributional properties of the misstatements. Since 1990, auditors and their clients have undergone significant changes as a result of information technology (refer to the Elliott Committee Report).

We find that IR factors associated with personnel issues are related to the incidence of misstatements at the financial statement level. These factors plus factors related to management integrity and prior period accounting adjustments are related to the magnitude of the misstatements. The IR assessment at the account level are moderately associated with both the incidence and magnitude of the detected misstatements. On the contrary, we find that the auditors' CR assessments are not associated with the incidence or magnitude of detected misstatements. As expected, all of the sample companies have partial or completely computerized accounting systems. Significantly more misstatements occurred in partially computerized companies due to inadequate segregation of duties and auditor disagreement with management's judgments. The client's internal control system failed to detect more misstatements in partially computerized systems because appropriate controls were missing or

³ Notable exceptions include Johnson (1987), and Icerman and Hillison (1990).

not properly applied. Finally, the magnitude of misstatements in a complex EDP environment were less than those in a non-complex environment.

The remainder of the paper is as follows. In the next section, we develop the research questions examined. This is followed by the methodology used to gather the data. The results for each issue are presented in the next two sections. The last section contains a summary, limitations, and concluding comments.

II. BACKGROUND AND RESEARCH QUESTIONS

Overview

The audit risk model ($AR = IR \times CR \times DR$) is the conceptual model that underlies the risk-based audit approach.⁴ The combination of the inherent risk and control risk components ($IR \times CR$) is sometimes referred to as "auditee risk" (Waller 1993; Messier 2000) since these components represent the risk that misstatements may exist *prior* to the audit. The auditor has no direct control over auditee risk. However, the auditor must assess the level of IR and CR in order to determine the extent of testing given a planned level of audit risk.⁵

Inherent risk is the susceptibility of an assertion to material misstatement, assuming no internal controls. Control risk is the risk that material misstatements that could occur will not be prevented or detected on a timely basis by an entity's internal controls. The use of the audit risk model requires that the auditor (1) set a planned level for audit risk (AR), (2) assess IR and CR,

⁴ Recently, a number of the major public accounting firms have developed new approaches (e. g., Arthur Andersen's The Business AuditSM and KPMG's Business Measurement Process) that expand the assessment of risks beyond those considered in the audit risk model to include all client business risks that might affect the entity's survival and profitability.

⁵ Professional standards allow an auditor to make a separate or combined assessments of IR and CR (AICPA 1999, AU 312.24).

and (3) solve the audit risk equation for the appropriate level of detection risk (DR).⁶ This process, especially the assessment of IR and CR, involves considerable judgment on the part of the auditor (AICPA 1999, AU 312.20; Messier 2000, 87).

Caster et al. (2000) describe the error generation and detection process, and how misstatements occur as a result of inherent and control risk factors. For example, misstatements may occur due to inherent risks such as complex judgments (e.g., the state of obsolescence of a high technology product). Similarly, incompetent personnel who do not conduct control procedures properly are a control risk that can lead to an increased occurrence of misstatements. It should also be noted that some inherent risks and control risks are not independent (Messier and Austen 2000). For example, if management is motivated to meet earnings forecasts and the control environment is weak, misstatements are likely to occur.

The assessment of the IR component of the audit risk model occurs at the beginning of the audit by evaluating specific risk factors related to the client that may increase or decrease the likelihood of material misstatement. In assessing CR, the auditor develops a preliminary understanding of internal control and then decides whether to rely or not rely on the controls. If the auditor decides to rely on controls, tests of controls are performed on the relevant controls to determine whether they are operating effectively.⁷ The use of significant information technology within a client's accounting system may differentially affect the incidence and magnitude of misstatement (Bell et al. 1998; Kinney 2000).

⁶ Auditing standards do not require a literal use of the model and state that it "is not intended to be a mathematical formula including all factors that may influence the determination of the individual risk components" (AICPA 1999, AU 350.48).

⁷ SASs 39, 47, and 82 provide guidance on assessing risk factors related to inherent risk and fraud, while SASs 55, 78, and 80 provide guidance on assessing control risk including the effect of information technology.

Inherent Risk Assessments

The presence of inherent risk factors on an audit is generally assumed to indicate that related financial statement accounts are likely to contain misstatements (see SASs 47 and 82). Findings from prior research on the relationship between IR factors and detected misstatements are mixed. Johnson (1987) examined the relationship between IR factors and relative magnitude of the misstatements for three accounts (inventory, accounts receivable, and accounts payable and accruals) and found that the results varied by account. For inventory, different types of misstatements were associated with certain client inherent risks (e.g., personnel turnover). However, for accounts receivable and account payable, none of the inherent risks had a significant relationship with the magnitude or direction of the detected misstatements. Waller (1993) reported a low association between the incidence of misstatements and auditor' assessments of IR at the assertion level.

On the other hand, Kreutzfeldt and Wallace (1986) and Wallace and Kreutzfeldt (1995) find that the inherent risks identified by the auditors had explanatory power in describing audit error rates. They examined a list of 166 risk measures that were included in a five-category scheme.⁸ Each of the three inherent risk categories (management competencies, management integrity, and company financial condition) was significant in explaining the incidence of misstatements. However, not all of the individual inherent risk factors included within a category were significant. Lastly, Houghton and Fogarty (1991) reported that a substantial majority of the misstatements occurred in audit areas where inherent risks existed. This discussion leads to the following research questions related to inherent risk:

⁸ Two of the five categories related to control risk.

RQ1: To what extent do auditors' assessments of inherent risk factors at the financial statement level relate to the incidence and magnitude of auditor-detected misstatements?

RQ2: To what extent is the assessed level of inherent risk at the account level associated with the incidence and magnitude of auditor-detected misstatements?

Control Risk Assessments

There should be direct relationship between the auditor's assessment of CR and the incidence and magnitude of misstatement. It is generally assumed that when an entity's internal controls are weak that more (and perhaps more material) misstatements are likely to occur. For example, a high assessment for control risk indicates that the client's controls are not properly designed or not operating effectively.⁹ In such cases, there should be an increased likelihood of misstatement in the accounts affected by the missing or ineffective controls. Early studies by Willingham and Wright (1985) and Johnson (1987) show no relationship between auditor assessment of control risk and the incidence of misstatements. Later studies (e.g., Icerman and Hillison 1990, Kreutzfeldt and Wallace 1990, Wallace and Kreutzfeldt 1995, Wright and Wright 1996) generally reported that the assessed strength of internal control was related to the incidence of misstatement.¹⁰ For example, Wright and Wright (1996) found that the assessed strength of account specific internal controls was related to the occurrence, impact, and direction of detected misstatements. This discussion leads to the following research question related to control risk:

RQ3: To what extent is the assessed level of control risk at the account level associated with the incidence and magnitude of auditor-detected misstatements?

⁹ Control risk might also be assessed as high because the auditor has determined that it is more efficient or effective to not rely on the controls and instead use substantive tests.

¹⁰ Eilifsen and Messier (2000) and Wright and Wright (1996) provide extensive reviews of this research.

The Effect of Information Technology

The last decade has seen tremendous growth in the use of information technology by organizations. Most business organizations have computerized their accounting information systems. Elliott (1994) and Bell et al. (1998) have suggested that accounting systems are now so well-controlled that very few misstatements occur in routine transaction processing. This results from having control procedures that were formerly completed by people now processed by computer programs. However, information technology does not eliminate all misstatements. Misstatements are still likely to occur where people interact with the computerized accounting systems (sometimes referred to as the boundary of the information system). The computerized accounting systems will also not eliminate misstatements that involve judgment on the part of the client personnel or management (e.g., estimates). Houghton and Fogarty (1991) found very few routine misstatements in their study, and many of the detected misstatements were caused by non-routine processing. However, they did not address the effect of information technology per se. Bell et al. (1998) examined the effect of computerization of accounting systems on the incidence and magnitude of misstatements. They tested 13 propositions related to misstatement attributes that might be impacted by the accounting system computerization. Bell et al. (1998) reported that incorrect manual computations, the recording of exchange documents, incorrect application of internal controls, and inadequate internal controls are more likely to be sources of problems when accounting systems are computerized. However, Bell et al. (1998, 37) acknowledge that one of the limitations of their study was that the data was gathered from audit engagements in 1989 and that information technology had changed significantly since that time. To emphasize this limitation, 44.6 percent (131 of 294) of their sampled companies reported that their accounting systems were *not* computerized. All of the sampled companies in the current

study are partially or completely computerized. Given the changes in information technology, it seems important to examine the following research question.

RQ4: Does the incidence and magnitude of auditor-detected misstatement, and their detection, differ between partially computerized and completely computerized accounting systems?

III. METHODOLOGY

Survey instrument

The survey instrument was constructed based on questionnaires used by Wright and Ashton (1989), Bell and Knechel (1994), and Bell et al. (1998) and tailored to a Norwegian accounting environment.¹¹ The instrument consisted of three major parts: (1) general information about the client, (2) assessments of IR factors, and (3) detailed information about the five largest detected misstatements.

Part I requested information on items such as the client's industry, selected financial data, the preliminary judgment about materiality,¹² the extent of computerization of information systems, and auditor reliance on controls. Part II required the engagement manager to indicate his or her agreement with 37 inherent risk factors (see Table 1). The inherent risk factors were grouped into three overall categories: management characteristics, operating and industry characteristics, or engagement accounting and auditing characteristics. Part III of the questionnaire collected information about each of the five largest misstatements

¹¹ The survey instrument was first constructed in English. It was then translated into Norwegian by one of the authors. A copy of the instrument is available from the authors.

¹² The preliminary judgment about materiality is the overall measure of materiality at the financial statement level.

detected by the auditors.¹³ The auditors were given the following guidance in identifying an item as a misstatement:

Not all audit differences are of interest from the standpoint of the research project. Differences which are a normal part of the audit (e.g., cash to accrual, income tax provision), an adjustment resulting from the application of a new accounting pronouncement/principle that went into effect during the year, or that result from specialized or government regulation should not be included as a part of the questionnaire unless there were unusual circumstances associated with determining the need for the adjustment. The project focuses on financial statement “misstatements” rather than audit adjustments that are expected and are essentially of an accrual or “bookkeeping” nature to properly reflect client balances at year end.

The auditors were asked to respond to a list of 28 questions related to each of the five largest misstatements, including the accounts where the misstatement occurred, the judged cause of the misstatement, the audit procedure that signaled the discovery of the misstatement, and the person who discovered the misstatement.¹⁴ More specifically, the auditors were asked to indicate their assessments of IR and CR for the financial statement area (account) associated with each misstatement and to respond to the 18 questions related to information technology.

Sample Selection

The six largest public accounting firms in Norway (the Big 5 plus the largest national firm) were asked to provide a representative sample of 10-15 audits with fiscal 1997 year-ends. The survey instruments were mailed to a contact partner in each firm who then distributed the instruments to the engagement partners of the sampled audits. Sixty-three engagement

¹³ The engagement manager was asked, at the end of the engagement, to determine the five largest audit differences whether subsequently recorded or waived, and whether it affected income or was a reclassifications. The staff member proposing the audit difference answered the questions posed in Part III of the research instrument. Audit team members were instructed to keep notes for each audit difference discovered during the engagement in order to respond to the questions listed. They were also instructed to refer to those notes when completing Part III of the questionnaire.

¹⁴ Eilifsen et al. (2000) present results for the financial statement accounts where the misstatements occurred, their causes, and the audit procedures that identified the misstatements. With a minor few exceptions, Eilifsen et al.'s results are comparable to prior research on these issues (Eilifsen and Messier 2000).

questionnaires were returned. Five engagements indicated that there was no auditor-detected misstatements found on the audit so they were eliminated from the analysis in this paper. The number of engagements provided by each firm ranged from 4 to 17. The 58 audits came from the following industries: merchandising (18); manufacturing (17); oil, gas & energy (5); shipping & transport (5); food, drink & tobacco (4); high technology (3); and other (6).

IV. RESULTS

Descriptive Engagement Data

The mean (median) revenues and assets for 58 sample companies are NOK717.6 million (NOK253.6 million) and NOK476.9 million (NOK192.9 million), respectively. Using the exchange rate (NOK7.5 = \$1) at the time the data was gathered, the mean revenues and assets are approximately \$98 million and \$64 million, respectively. On average, the companies are profitable (NOK25.8 million, \$3.45 million) and have significant equity (NOK169 million, \$22.5 million). The auditor's average preliminary judgment about materiality was NOK2.8 million (\$387,000).

The auditors were asked (1) to indicate the total number of misstatements detected on each engagement and (2) to provide detailed information on the five largest misstatements detected. Seven hundred fourteen (714) misstatements (including 114 reclassification entries) were reported; of which 535 were auditor discovered and 179 were client requested. The data on the five largest misstatements showed 240 misstatements affecting 481 financial statement accounts. The auditors reported that 157 (65 percent) of these misstatements were booked while 83 (35 percent) were waived. The mean amount for the misstatements booked was NOK2,104,000 (\$280,500) while the mean adjustment for the waived misstatements was NOK1,015,000 (\$136,900). This difference was significant ($t=1.5$, $p=.06$).

The distribution of misstatements by account shows that most misstatements occurred in following balance sheet accounts: accounts receivables (6 percent), other receivables (6 percent), inventory (8 percent), accrued liabilities (7 percent), and other short-term liabilities (6 percent). Related income statement accounts contained the following percentage of errors: revenue (5 percent), raw materials (7 percent), administrative expenses (7 percent), and financial items (6 percent). This distribution of misstatements by account is comparable to prior research (Eilifsen and Messier 2000).

Inherent Risk Assessments

We gathered two sets of inherent risk assessments. The auditors were first asked to indicate the extent to which they agreed or disagreed (using a 5 point scale from strongly agree to strongly disagree) with the presence of each of the 37 inherent risk factors with regard to the sample engagement. These assessments represent the inherent risk assessments at the financial statement level. The auditors also provided inherent risk assessment (using a 3 point scale: high, moderate, or low) for the financial statement account associated with each of the five largest misstatements.

Analysis at the Financial Statement Level.

Table 1 presents the auditors' assessment of the 37 inherent risk factors for each audit grouped by: (1) management characteristics, (2) operating and industry characteristics, and (3) engagement accounting and auditing characteristics.¹⁵ Only three inherent risk factors in the management characteristics category were rated as being a risk on the sample companies (see Table 1, Panel A). These include: (1) personnel turnover in accounting, finance, and operation is

¹⁵ The wording of the inherent risk factors in the survey instrument was such that agreement was indicative of the presence of the inherent risk factor on the engagement (see Table 1). We used a total of 15 percent for the “strongly agree” and “agree” rating categories as an arbitrary cutoff for discussing an IR factor in this section.

high, (2) personnel are inexperienced or inadequate in number; and (3) management's operating and financing decisions are dominated by a single individual or a few persons acting in concert (22.4, 20.7, and 19.0 percent strongly agreed or agreed, respectively). The remaining inherent risks were rated relatively low.

[Insert Table 1 here]

Six risk factors in the operating and industry characteristics group were assessed as being inherent risks for the sample companies (see Table 1, Panel B). These included (1) the industry was subjected to strict environmental controls (31.0 percent strongly agreed or agreed), (2) the client's success was dependent on a single product or a small number of products and transactions (31.0 percent strongly agreed or agreed), (3) the client's operating results were particularly sensitive to economic factors (27.6 percent strongly agreed or agreed), (4) there were potential threats from technological obsolescence of the client's products (24.2 percent strongly agreed or agreed), (5) the flow of goods from suppliers' were susceptible to cost, quality, and/or quantity fluctuations (20.7 percent strongly agreed or agreed), and (6) physical location of the client's operations makes effective management difficult (15.5 percent agreed).

In the engagement accounting and auditing characteristics group, six risk factors were assessed by the auditors as present on the sampled engagements (see Table 1, Panel C). These inherent risks include (1) the presence of material, complex accounting estimates (36.2 percent strongly agreed or agreed), (2) accounts required adjustments in prior period (29.9 percent strongly agreed or agreed), (3) significant and/or unusual related party transactions (29.3 percent strongly agreed or agreed), (4) considerable manual intervention required in capturing, processing, and/or summarizing data (25.9 percent strongly agreed or agreed), (5) significant

foreign operations (25.8 percent strongly agreed or agreed), and (6) there are significant and complex tax problems (17.6 percent strongly agreed or agreed).

We tested RQ1 by performing a number of regressions using (1) the total number of auditor-discovered misstatements reported and (2) the magnitude of the largest misstatements. We first ran three factor analysis, one for each category of IR risk factors. Since certain IR factor assessments lacked sufficient dispersion for meaningful analysis we eliminated those factors where 15% or fewer responses were in the strongly agreed or agreed categories.¹⁶ Table 2 presents the results of the factor analysis.¹⁷ In the following discussions, we will call the 37 factors in Table 1 “IR” factors and the factors that result from the factor analysis as “FA” factors.

[Insert Table 2 here]

The regression results for each of the three categories using both the total number of auditor discovered misstatements and the magnitude of the misstatements are shown in Table 2.¹⁸ For the incidence (i.e., the total number of misstatements), we find that one FA factor within the management characteristics is significant: personnel issues ($t=2.52, p=.015$). None of the FA factors in the operating and industry characteristics or engagement and auditing characteristics categories were significant.

¹⁶ Wallace and Kreutzfeldt (1995) performed a similar elimination procedure.

¹⁷ We also performed a factor analysis using all 37 IR factors. This resulted in 12 factors with eigenvalues > 1 . Seven management characteristics and 1 engagement characteristic loaded on the first factor. The remaining eleven factors contained a mixture of the remaining IR factors. Because the auditors evaluated the IR factors by the three categories, we believe that it is more appropriate to report on the analysis using the category results.

¹⁸ We also ran 37 individual regression with the total number of auditor-discovered misstatements as the dependent variable and the auditors’ assessment of the individual inherent risk factor as the independent variable. Only two regressions were significant: “Personnel are inexperienced or inadequate in number” and “Management’s operating and financing decision are dominated by a single individual or a few persons acting in concert.” We then ran a regression model that included the two significant inherent risk factors. The results indicate that both inherent risk factors remain significant in predicting the total number of auditor-discovered misstatements.

The relationship of the IR factors to the magnitude of the misstatements was tested using a similar analysis, except that the dependent variable was the size of misstatement ÷ total assets.¹⁹ For the management characteristics category both FA factors were significant: management integrity (t=2.35, p=.020) and personnel issues (t=3.13, p=.002). None of the FA factors were significant in the operating and industry characteristics category. The three FA factors in the engagement accounting and auditing category were significant: complexity (t=-2.31, p=.022), manual intervention (t=-2.30, p=.023), and prior period accounting adjustments (t=3.88, p=.000). We have no explanation for the sign of the manual intervention and complexity factors being in the opposite direction of that expected. The result for prior period accounting adjustments is consistent with previous research.

In summary, we find that personnel issues are significantly related to the incidence of misstatements. An examination of the causes of the misstatements as reported by the auditors indicates that personnel-related causes accounted for 53.4 percent of the misstatements (personnel problems = 16.8 percent, insufficient accounting knowledge = 21.2 percent, and judgment errors = 15.4 percent). This is consistent with prior research such as Hylas and Ashton (1982) who found that personnel issues accounted for 56.6 percent of misstatements. The FA factors management integrity and personnel issues are both related to the magnitude of misstatements. None of the FA factors in the operating and industry characteristics category are related to either the incidence or magnitude of misstatements. Lastly, no FA factors in the engagement accounting and auditing characteristics were related to the incidence of misstatements. However, three FA factors show a relationship to the magnitude of

¹⁹ This dependent variable “normalizes” the magnitude of the misstatement. We also tested two other dependent variables: (1) magnitude of the misstatement ÷ preliminary judgment about materiality and (2) magnitude of the misstatement ÷ tolerable misstatement. No FA factors were significant in these analyses.

misstatements. The dominance of management-related and personnel type factors for predicting the incidence and magnitude of misstatements is consistent with prior research on the relationship of IR factors to detected misstatements (Eilifsen and Messier 2000). The lack of significance of industry and product-related factors is surprising. These factors are cited frequently in the practitioner literature as risks that auditors should consider. The risk factors identified in the engagement accounting and auditing characteristics category support prior findings. For example, Kinney (1979) found that one of the best predictors of misstatements was the incidence of misstatements in the prior year. Our findings show that there is a strong relationship between the auditors' assessment of IR factors and the incidence and magnitude of misstatements (RQ1).

Analysis at the Account Level.

RQ2 asks the extent to which the assessed level of inherent risk at the account level is associated with the incidence and magnitude of the detected misstatements. For each of the five largest misstatements reported, the auditors provided an inherent risk assessment (high, moderate, or weak) at the financial statement account level. Table 3 reports incidence of misstatements categorized by the auditors' assessment of inherent risk by account. Overall, the assessments of inherent risk by each account indicated 14% were assessed high, 54% assessed moderate, and 32% assessed low. If one assumes that assessments of high or moderate indicates a high probability that the account contains a misstatement, the auditors' assessments are fairly accurate (68 percent). The auditor's "accuracy" for some major accounts (e.g., accounts receivable, inventory, and their related income statement accounts) were quite high (> 80 percent). Overall, the auditors' IR assessments at the account level were associated with the incidence of misstatements, especially in selected major financial statement accounts.

[Insert Table 3 here]

The relationship of the auditors' IR assessments to the magnitude of the misstatements was tested in an ANOVA with magnitude (misstatement amount ÷ total assets) of the misstatement as the dependent variable and the inherent risk assessment at the account level as the independent variable. The results were marginally significant ($F=2.57$, $p=.079$), indicating that higher IR assessments were associated with larger misstatements.

In summary, our results show that auditors' IR assessments are marginally associated with both the incidence and magnitude of detected misstatements (RQ2).

Control Risk Assessments

It is generally assumed that there is a direct relationship between the quality of the client's control system and the incidence of misstatements. Therefore, low control risk assessments should result in the auditor finding few misstatements, and high to moderate control risk assessment should indicate more misstatements. RQ3 asks the extent that auditors' assessments of control risk at the account level are associated with the incidence and magnitude of the detected misstatements. We requested the auditors' provide their control risk assessments at the account level for each of the five largest detected misstatements using a 4 point scale (high, moderate, low, and very low).

Table 4 reports the auditors' assessment of control risk at the financial statement account level. The assessments of control risk by each account where a misstatement occurred indicates that for the majority of accounts (55 percent) where misstatements were detected, the auditors assessed control risk to be high or moderate while 45 percent were assessed low or very low.²⁰ If one assumes that assessments of high or moderate indicate the probability that the account

²⁰ Because there were few very low assessments, we combined them with the low assessments.

contains a misstatement, the auditors' assessments of control risk were less accurate than their inherent risk assessments (55 versus 68 percent). The auditor's accuracy for certain major accounts (e.g., accounts receivable, inventory, and their related income statement accounts) was also lower than the inherent risk assessments for those accounts.

[Insert Table 4 here]

The relationship of the auditors' CR assessments to the magnitude of the misstatements was tested in an ANOVA with magnitude (misstatement amount ÷ total assets) of the misstatement as the dependent variable and the control risk assessment at the account level as the independent variable. The results were not significant ($F=1.90$, $p=.131$). Thus, the higher CR assessments were not associated with the magnitude of the detected misstatements.

In summary, our results show that auditors' CR assessments do not appear to be associated with either the incidence and magnitude of detected misstatements (RQ3). As we find in the next section, these insignificant results are explained by the effect of IT.

The Effect of Information Technology

Descriptive Information

The auditors reported that the accounting systems of all sampled companies were partially or completely computerized. This shows the increased use of IT by entities in the nine years since the Bell et al. (1998) data were gathered. Thirty-six engagements were assessed as having partially computerized accounting systems while 23 were completely computerized. The average number of misstatements per engagement was the same (4.14 vs. 3.94). This differs from the results in Bell, et al. (1998) in which audit differences were more frequent when systems were computerized (3.58 noncomputerized/5.48computerized). Our results indicate a

lower overall misstatement rate than Bell et al. (4.14 vs. 5.48). We believe this result indicates improved internal control in computerized systems.

We also collected a measure of complexity of the EDP system. We defined complexity as “the EDP environment is characterized by high user dependence on EDP control procedures.” Twenty-two engagements were assessed as having a complex EDP environment while 41 were not complex. The average number of misstatements per engagement was the same (3.64 complex/3.90 not complex).

We also asked the auditors how long the client’s accounting system had been computerized. Sixty-seven percent had been computerized for more than 10 years, twenty-one percent for 5-10 years, eleven percent for 2-5 years, and one percent for less than 2 years. The auditors were also asked to indicate which accounting system areas were computerized. As Table 5 shows, most of the major accounting areas (receivables, inventories, payables, and related income statement accounts) were computerized.

[Insert Table 5]

Table 5 also shows the reliance decisions made by the auditors when the client’s accounting system was computerized while Table 6 presents the reasons for *not* relying on IT controls. The auditors relied on IT controls a majority of the time for significant accounting areas (e.g., cash, trade receivables, inventory, property, plant, and equipment, payables, and payroll). When the auditor did not rely on the IT controls, it was typically because substantive testing was more effective or efficient. Seldom did the auditors report that the nonreliance decision was based on weak controls. The auditors reported that they spent 22.8 hours, on average, assessing the reliance of the accounting system.

[Insert Table 6]

RQ4 asked whether the incidence and magnitude of the auditor-detected misstatements differed between partially computerized and fully computerized accounting systems. The next two subsections present our findings.

IT and the Incidence of Misstatements

We asked the auditors to answer 18 questions related to IT for each detected misstatement. The auditors' responses were analyzed by splitting the sample based on whether the client's accounting system was partially or completely computerized. Table 7 presents these data.

[Insert Table 7]

The auditors responded to 12 IT factors based on the question "Did the misstatement occur..." and 4 IT factors related to the question "Did the client's system of internal control fail to detect the misstatement because..." Responses to two additional questions were also requested. Table 7 shows the percentage of misstatements that were related to these factors. There was a significant difference between the causes of the misstatements in partially versus completely computerized systems because there was not adequate segregation of duties (5.3 vs. 0.0) and the auditor disagreed with management's judgment (11.9 vs. 4.5). The first finding would be expected because partially computerized system are more likely to have less segregation of duties. It is not obvious why there was more disagreement with management's judgment in partially computerized systems. There were two significant reasons for why the client's system failed to detect the misstatement in partial versus completely computerized systems: appropriate controls were missing (31.3 vs. 16.0) and controls were not properly applied (23.9 vs. 12.8). Both of these finding are consistent with expectations for partially computerized systems.

Analyzing these questions by not complex versus complex shows that more misstatements occurred in environments that were not complex because methods used to select, train and supervise both accounting personnel (20.1 vs. 7.4) and management personnel (7.0 vs. 1.6) were inadequate. Again, the two significant reasons for why the client's system failed to detect the misstatement in not complex versus complex computerized systems were: appropriate controls were missing (33.7 vs. 13.6) and controls were not properly applied (19.8 vs. 7.8).

IT and the Magnitude of Misstatements

The mean magnitude of the misstatements (misstatement amount ÷ total assets) for partially computerized systems was .0091 versus .0067 for completely computerized systems. An ANOVA was run with the extent of computerization as the independent variable and the magnitude of the misstatement as the dependent variable. There was no significant difference ($F=1.44$, $p=.232$) between partial and completely computerized systems. This finding is consistent with previous research (Bell et al. 1998). There was, however, a marginally significant difference in magnitude of misstatements for complex (.0052) versus non-complex (.0089) EDP environments ($F= 3.24$, $p=.0729$).

V. SUMMARY, LIMITATIONS, AND CONCLUDING COMMENTS

This paper examined the relationship between auditors' risk assessments and detected misstatements by examining three research questions. RQ1 asked the extent to which auditors' assessments of inherent risk factors at the financial statement level relates to auditor-detected misstatements. Overall, our results show that the detected misstatements were associated with a limited number of inherent risk factors. The regression results show that only a small subset of those inherent risk factors is associated with the number and/or magnitude of misstatements.

RQ2 examined the extent to which the incidence of misstatements varied by the auditors' assessment of inherent risk at the account level. Auditors judged inherent risk high or moderate for 68% of the assessments. A test of the magnitude of the misstatements and the auditors' assessment of inherent risk was marginally significant.

RQ3 examined the extent to which the incidence of misstatements varied by the auditors' assessment of control risk at the account level.

This paper also examined the relationship between information technology and detected misstatements (RQ4). We found that virtually all sample companies had partial or completely computerized accounting systems. The cause of misstatements in partially computerized companies by inadequate segregation of duties and auditor disagreement with management's judgments was greater than in computerized systems. The magnitude of misstatements was marginally greater in non-complex EDP environments than complex EDP environments. Lastly, the client's internal control system failed to detect more misstatements in partially computerized systems because appropriate controls were missing or not properly applied.

Our results on the limited relationship of inherent risk factors to detected misstatements have implications for the audit risk model. A joint working group from Canada, the UK and the US are currently examining the audit risk model. Our result should provide valuable information for their deliberations. It was not surprising that most clients have extensive computerization of their accounting systems. This has implications for audit education and research. From an education perspective, it reinforces a need to use more computerized examples of accounting systems in accounting and auditing classes. Our findings also suggest that audit researchers should take a closer look at how knowledge of IT might impact audit judgment.

Table 1
Auditors' Assessments of Inherent Risk Factors at the Financial Statement Level

Panel A: Management Characteristics						
Inherent Risk Factors	SA*	A	N	D	SD	
1. Management's attitude toward financial reporting is unduly aggressive.	3.4	5.2	5.2	41.4	44.8	
2. Personnel turnover in accounting, finance, and operations (especially in senior accounting positions) is high.	10.3	12.1	1.7	20.7	55.2	
3. Personnel are inexperienced or inadequate in number.	0.0	20.7	15.5	34.5	29.3	
4. Evidence of personnel dishonesty is present.	1.7	0.0	0.0	5.2	93.1	
5. Management has undue emphasis on meeting earnings projections (consider desire to support the price of the client's stock, maintain the market value of securities, or receive bonuses and other forms of compensation).	3.4	3.4	6.9	39.7	46.6	
6. Management's operating and financing decisions are dominated by a single individual or a few persons acting in concert.	5.2	13.8	22.4	36.2	22.4	
7. The client and/or management is not considered respectable by the business community.	0.0	1.7	3.4	19.0	75.9	
8. Management is not concerned with reporting accurate financial information.	1.7	0.0	5.2	46.6	46.6	
9. Management is not concerned with providing additional information to improve the clarity and comprehensiveness of the company's financial statements.	1.7	3.4	13.8	41.4	39.7	
10. Members of management are experiencing personal financial difficulties.	1.8	0.0	15.8	8.8	73.7	
11. Evidence of management overriding significant internal accounting controls is present.	1.7	0.0	6.9	24.1	67.2	
Panel B: Operating and Industry Characteristics						
Inherent Risk Factors	SA	A	N	D	SD	
12. The client has inadequate or inconsistent profitability relative to the industry.	1.7	12.1	20.7	36.2	29.3	
13. The client's operating results are particularly sensitive to economic factors (such as inflation and interest rates).	0.0	27.6	13.8	44.8	13.8	
14. There are adverse legal or regulatory problems confronting the client or industry.	3.4	10.3	25.9	24.1	36.2	
15. There are adverse political, social or economic conditions confronting the industry.	1.7	8.6	20.7	31.0	37.9	
16. The flow of products or services from the client's suppliers is susceptible to cost, quality, and/or quantity fluctuations.	6.9	13.8	19.0	36.2	24.1	
17. There is potential for the client's product to become technologically obsolete.	5.2	19.0	6.9	20.7	48.3	
18. Production cycles are longer than the client's fiscal year.	10.5	3.5	14.0	17.5	54.4	
19. Physical location of the client's operations makes effective management difficult.	0.0	15.5	10.3	25.9	48.3	
20. Industry is subject to strict environmental controls.	6.9	24.1	29.3	13.8	25.9	
21. The client has a complex capital structure.	0.0	3.4	10.3	36.2	50.0	
22. Client's success depends on a single product or a small number of products or transactions.	10.3	20.7	13.8	29.3	25.9	
23. The client is experiencing solvency problems or other factors that bring into question the entity's ability to continue as a going concern.	0.0	0.0	3.4	19.0	77.6	

Panel C: Engagement Accounting and Auditing Characteristics

Inherent Risk Factors		SA	A	N	D	SD
24.	Physical location of the client's operations makes effective adequate monitoring and a reporting system difficult.	0.0	10.3	13.8	36.2	50.0
25.	Electronic processing (e.g., EDI - electronic data interchange) of accounting data has resulted in complex accounting and/or auditing problems.	0.0	13.8	12.1	44.8	29.3
26.	There are significant and/or unusual related party transactions.	6.9	22.4	8.6	37.9	24.1
27.	There are material loss contingencies.	1.7	5.2	8.6	31.0	53.4
28.	There have been material, complex accounting estimates.	8.6	27.6	8.6	34.5	20.7
29.	There is existing or pending material litigation between shareholders and management.	0.0	0.0	0.0	6.9	93.1
30.	The assets are susceptibility to loss or misappropriation.	0.0	12.1	8.6	37.9	41.4
31.	The client has completed unusual and complex transactions, particularly at or near the end of the accounting period.	0.0	6.9	3.4	25.9	63.8
32.	There are significant foreign operations.	13.8	12.1	5.2	15.5	53.4
33.	There is considerable manual intervention required in capturing, processing, and/or summarizing data.	3.4	22.4	29.3	32.8	12.1
34.	New client has no prior audit history or insufficient information is available from the predecessor auditor.	8.6	1.7	0.0	8.6	81.0
35.	Management places undue pressure on the auditors with regard to the time and/or fees.	0.0	1.7	3.4	43.1	51.7
36.	The accounts required adjustments in prior period.	8.8	21.1	15.8	21.1	33.3
37.	There are significant and complex tax issues.	5.3	12.3	5.3	40.4	36.8

* SA = strongly agree, A = agree, N = neither agree or disagree, D = disagree, SD = strongly disagree
Shaded areas refer to IR factors that have SA and A totals greater than 15%.

Table 2
Factor Analysis and Regression Results for the
Incidence and Magnitude of Misstatements at the Financial Statement Level

Inherent Risk Category	Factor 1	Factor 2	Factor 3
<u>Management Characteristics:</u>			
Factor Name	Management integrity	Personnel issues	
IR Factors Included ^a	6	2, 3	N/A
<u>Regression Results</u>			
<i>Dependent Variable:</i>			
Total No. of Misstatements	n/s	t=2.52, p=.015	
Magnitude of Misstatements ^b	t=2.35, p=.020	t=3.13, p=.002	
<u>Operating and Industry Characteristics:</u>			
Factor Name	Industry issues	Product-related issues	Single product success
IR Factors Included ^a	19, 20	13, 16, 17	22
<u>Regression Results</u>			
<i>Dependent Variable:</i>			
Total No. of Misstatements	n/s	n/s	n/s
Magnitude of Misstatements ^b	n/s	n/s	n/s
<u>Engagement Accounting and Auditing Characteristics:</u>			
Factor Name	Manual intervention	Prior period adjustments	Complexity
IR Factors Included ^a	33	36	26, 28, 32, 37
<u>Regression Results</u>			
<i>Dependent Variable:</i>			
Total No. of Misstatements	n/s	n/s	n/s
Magnitude of Misstatements ^b	t=-2.30, p=.023	t=3.88, p=.000	t=-2.31, p=.022

^a See Table 1 for the name of the individual inherent risk factor.

^b The magnitude of the misstatement was calculated by: size of misstatement ÷ total assets.

^c It was not possible to name these factors because of the combination of inherent risks included.

Table 3
Assessment of Inherent Risk at the Financial Statement Account Level

Account Name	Number of Misstatements	Inherent Risk Assessment		
		High %	Moderate %	Low %
Accounts receivable	29	14	66	20
Other receivables	26	12	34	54
Inventory	39	41	41	18
Accounts payable	21	10	57	33
Accrued liabilities	32	6	66	28
Other short-term liabilities	27	4	37	59
Revenue	25	20	56	24
Raw materials etc.	35	31	49	20
Wages and other personnel costs	22	19	59	22
Administrative expenses etc.	35	3	77	20
Financial items	28	4	53	43
All other accounts	162	12	51	37
Totals	481	14	54	32

Note: Information was gathered for 29 accounts. There were 240 misstatements affecting in 481 financial statement accounts. In the interest of parsimony, only those accounts with greater than 20 misstatements are presented in detail.

Table 4
Assessment of Control Risk at the Financial Statement Account Level

Account Name	Number of Misstatements	Control Risk Assessment		
		High	Moderate	Low or Very Low
		%	%	%
Accounts receivable	29	3	62	35
Other receivables	26	8	38	54
Inventory	39	26	38	36
Accounts payable	21	9	48	43
Accrued liabilities	32	3	53	44
Other short-term liabilities	27	4	19	77
Revenue	25	12	48	40
Raw materials etc.	35	14	54	32
Wages and other personnel costs	22	9	41	50
Administrative expenses etc.	35	12	51	37
Financial items	28	4	50	46
All other accounts	161	12	42	46
Totals	481	11	44	45

Note: Information was gathered for 29 accounts. There were 240 misstatements affecting in 481 financial statement accounts. In the interest of parsimony, only those accounts with greater than 20 misstatements are presented in detail.

Table 5
Descriptive Information on Accounting System Area Computerization
and Auditor Reliance Decisions

Accounting System Area	The client's accounting system is computerized			If the client's system is computerized were the EDP controls relied upon?		
	n*	Yes	No	n	Yes	No
Cash Balances	61	44.3	55.7	26	65.4	34.6
Trade Receivables, Sales, Returns, and Collections	60	96.7	3.3	56	76.8	23.2
Inventories, Cost of Sales	54	88.9	11.1	47	68.1	31.9
Nontrade Receivables	59	49.2	50.8	27	48.1	51.9
Investments	61	41.0	59.0	23	56.5	43.5
Prepaid Expenses, Deferred Charges, Intangibles, and Other Assets	50	26.0	74.0	12	41.7	58.3
Property, Plant, and Equipment	61	55.7	44.3	32	68.8	31.2
Accounts Payable, Purchases, and Payments	62	95.2	4.8	58	77.6	22.4
Payroll and Related Costs	62	95.2	4.8	58	84.5	15.5
Leases	43	21.4	78.6	8	25.0	75.0
Indebtedness	60	41.7	58.3	23	47.8	52.2
Taxes on Corporate Income	59	27.1	72.9	15	33.3	66.7
Ownership Equity	60	28.3	71.7	16	37.5	62.5
Other	3	66.7	33.3	2	0.0	100.0

* The entire sample of 63 firms was included in this table since the answer to this question was not directly related to the existence of misstatements. The number of engagements for which this question was answered varied since some participants did not provide the requested information.

Table 6
Reason for not Relying on IT controls

Accounting System Area	n	Reasons for Not Relying on IT Controls								
		Missing or ineffective controls over manual follow-up procedures	Weak EDP control environment	Weak access and systems development procedures	Weak physical/logical access controls	Weak system documentation	Substantive testing was more efficient	Substantive testing was more effective	Adequate user controls over entire processing stream-relied on user controls	Other
		%	%	%	%	%	%	%	%	%
Cash Balances	19	10.5	0.0	5.3	0.0	0.0	36.8	36.8	5.3	5.3
Trade Receivables, Sales, Returns, and Collections	25	12.0	8.0	0.0	4.0	0.0	24.0	40.0	8.0	4.0
Inventories, Cost of Sales	25	20.0	12.0	4.0	4.0	0.0	28.0	20.0	4.0	8.0
Nontrade Receivables	22	4.5	0.0	0.0	0.0	0.0	41.0	50.0	0.0	4.5
Investments	18	5.6	0.0	0.0	0.0	0.0	44.3	38.9	5.6	5.6
Prepaid Expenses, Deferred Charges, Intangibles, and Other Assets	14	7.1	0.0	0.0	0.0	0.0	42.9	42.9	0.0	7.1
Property, Plant, and Equipment	18	5.6	0.0	0.0	0.0	0.0	44.3	38.9	5.6	5.6
Accounts Payable, Purchases, and Payments	24	0.0	4.2	0.0	4.2	0.0	33.3	41.6	12.5	4.2
Payroll and Related Costs	19	0.0	5.3	5.3	10.5	0.0	26.3	36.8	10.5	5.3
Leases	11	0.0	0.0	0.0	0.0	0.0	36.4	54.5	0.0	9.1
Indebtedness	22	4.5	0.0	0.0	0.0	0.0	45.5	45.5	0.0	4.5
Taxes on Corporate Income	18	5.6	0.0	0.0	0.0	0.0	38.9	44.4	0.0	11.1
Ownership Equity	18	5.6	0.0	0.0	0.0	0.0	38.9	44.4	0.0	11.1
Other	2	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0
Overall		6.7	2.8	1.2	2.0	0.0	36.9	39.7	4.4	6.3

Table 7
The Effect of IT and Misstatement Rates

	Audit Misstatement Rates		Audit Misstatement Rates	
	Computerized?		EDP Environment?	
	Partially	Completely	Not Complex	Complex
Total Number of Misstatements	149	91	160	80
Total Number of Engagements	36	23	41	22
Average Number of Misstatements per Engagement	4.14	3.96	3.93	3.73
	% ^a	%	% ^a	%
<u>Did the misstatement occur:</u>				
because the workload of accounting personnel does not permit satisfactory job performance?	12.3	9.9	13.4	8.2
because the segregation of duties among accounting personnel was inadequate?	5.3*	0.0	3.7	1.6
because the methods used to select, train and supervise accounting personnel were inadequate?	16.0	11.5	20.1**	7.4
because the methods used to select, train and supervise management personnel were inadequate?	4.1	4.5	7.0*	1.6
at the boundary of an information stream?	4.9	1.6	3.4	3.4
during input into the computer system?	0.4	0.4	0.0	0.8
because of erroneous data in an exchange or source document?	0.0	0.8	0.4	0.4
because an information stream failed to capture an exchange or source document?	0.8	0.0	0.8	0.0
in an information stream where we relied on the client's EDP controls?	4.1	0.4	0.4	4.1
because of management override of the control system?	0.0	0.8	0.8	0.0
because the auditor disagreed with management's judgment?	11.9*	4.5	7.8	8.6
because of inadequate physical security over movable and valuable assets?	0.4	0.8	0.8	0.4
<u>Did the client's system of internal control fail to detect the misstatement because:</u>				
appropriate controls were missing?	31.3**	16.0	33.7**	13.6
the controls are performed on a test basis?	1.6	2.0	1.2	2.5
the controls were poorly designed?	9.5	9.9	19.8**	7.8
controls were not properly applied?	23.9*	12.8	23.5	13.2
Was the misstatement caused by incorrect data which was manually determined or calculated?	5.3	2.5	3.3	4.5
Was the misstatement attributable in any way to the client's computer system?	0.4	1.6	1.2	0.8

^aMisstatement rate percentages are based on the frequency of misstatement causes and internal control characteristics relative to the population of all observed misstatements. The percentages do not add up to 100% because more than one attribute of interest may be present in any given misstatement.

* Difference between partially and completely computerized settings significant at p=.07 (χ^2 test)

** Difference between partially and completely computerized settings significant at p<.05 (χ^2 test)

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