

The Effect of Time Pressure, Task Complexity and Litigation Risk on Auditors' Reliance on Decision Aids

Abstract

Auditors' reliance on decision aids has been the subject of much research in the decision-aid literature. Extant literature shows that auditors are somewhat reluctant to rely on decision aids throughout the audit process, despite potential improvement in decision accuracy. The objective of this study is to empirically examine the extent to which auditors' reliance on decision aids is associated with the perceived levels of time pressure, task complexity and litigation risk—decision aid reliance factors that have been understudied in the auditing literature. In a 2 x 2 x 2 between-subjects experimental design, the independent variables were manipulated as follows: time pressure (high, low), task complexity (high, low) and litigation risk (high, low). The dependent variable reflects the level of reliance on a decision aid. Study results indicate a positive relationship between each of the three factors and decision aid reliance. A three-way interaction was also indicated, suggesting that the joint effect of litigation risk and task complexity depends on the level of perceived time pressure. Study findings hold implications for both practicing auditors and audit researchers, particularly in the increasingly litigious environment in which auditors are immersed.

Key Words: decision aids; auditing; litigation risk; time pressure; task complexity

1. Introduction

It is generally argued that proper use of decision aids can improve decision accuracy, thus audit effectiveness (Benbasat and Nault, 1990; Ashton 1992; Vlemmix et al., 2012). Extant literature, however, shows that auditors are somewhat reluctant to rely on decision aids (Pincus, 1989; Ross, 2002; Boritz, and Timoshenko, 2014). Audit research in the area of decision aid reliance has mainly been limited to the effect of incentives, feedback, expertise, knowledge and justification (e.g., Ashton, 1990; Boatsman et al., 1997; and Rose, 2002). The current study furthers this line of research by examining the main and interactive effects of three additional factors that have received much attention in audit research, but little consideration in the auditing decision aid literature – litigation risk, time pressure and task complexity (e.g., Palmrose, 1988; Alderman and Deitrick, 1982; Arnold et al., 1997; Bonner, 1994).

A major source of time pressure in an audit environment arises from budget constraints. Several studies have indicated that audit performance can deteriorate when auditors work under excessive time pressure (e.g., Alderman and Deitrick, 1982; Arnold et al., 1997). When time is a constraint, decision aids can enhance the efficiency, and some would argue the effectiveness, of auditors' decision-making processes, especially in highly structured environments.

Task complexity is another important factor in the decision aid reliance equation. Many audit tasks are highly complex and the intricacy of such tasks can have a major impact on audit judgments (Bonner, 1994; Libby, 1985). The use of decision aids in the decision making process can help improve judgment quality, thus audit effectiveness, when task complexity increases.

The third decision aid reliance factor examined in this study deals with audit litigation risk. The seriousness of the problem is evident by the increasing number of lawsuits filed against audit firms (St. Pierre and Anderson, 1984; Palmrose, 1988; Stice, 1991; Gomaa et al., 2008; and Arel, 2010), which serves to heighten auditors' awareness that they need to pay a great deal of attention to audit quality. When faced with a high risk of litigation, the use of a decision aid can improve audit effectiveness and help auditors justify their judgment decisions should a lawsuit be filed (Lowe and Reckers, 2002).

Despite potential improvement in decision accuracy provided by the use of decision aids, current practices show that auditors rely more on their judgment than on decision aids throughout the auditing process (Pincus, 1989; Ross, 2002; Boritz and Timoshenko, 2014). Existing research provides little explanation for such behavior. The current study proposes that under-reliance might be explained by a lack of sufficient exogenous pressure, and argues that client litigation risk has become so dominate and costly in the U.S. that auditors are now more consciously aware than ever of the benefits of decision aids.

The between-subjects experiment reported herein manipulated time pressure (high, low), task complexity (high, low) and litigation risk (high, low). The dependent variable reflects the level of reliance on a decision aid. Study results suggest a positive relationship between each of the three factors and decision aid reliance. A significant three-way interaction suggests that the effect of litigation risk and task complexity on decision aid reliance depends on the perceived level of time pressure

Research of this nature is especially important in light of the increased litigation risk and related cost faced by the audit profession. Findings from this study provide further understanding of auditor judgment and decision-making with respect to reliance on decision aids, and open the door for future research in this area.

2. Background and Hypotheses

2.1 Time Pressure

Two lines of research can be identified in the existing time pressure literature (Arnold et al., 2000). The first examines behavioral responses to time pressure (e.g., Mann and Tan, 1993; Alderman and Dietrick, 1982; and Arnold et al., 1997), while the other investigates the effects of time pressure on cognitive decision making processes (e.g., Smith et al., 1997; and Arnold et al., 2000). Both lines of research suggest that when individuals make judgmental decisions under time pressure, they are subject to “hypervigilance” (Mann and Tan, 1993). The concept of hypervigilance refers to a mental state in which a decision maker, when placed under a relatively high level of perceived time pressure, “is reduced to panicky, incomplete information search before selecting an (often) inferior course of action” (p. 189). Also, as noted by Mann and Tan (1993, 198), this often results in “high stress, a marked deterioration in thinking and judgment, a narrowing perception of options, an incomplete and haphazard search of information, vacillation, and, finally, an impulsive choice.”

Behavioral studies examining the effect of time pressure in auditing environments indicate that audit performance deteriorates due to time pressure through narrowed scopes, reduced work on certain audit procedures, reliance on lower quality evidence,

premature audit sign-offs, and omission of some audit procedures (e.g. Alderman and Deitrick, 1982; Arnold et al., 1997, 2000). The second line of time pressure research, focusing on the effects of time pressure on decision-making processes (e.g., Arnold et al., 2000; Smith et al., 1997), supports the behavioral findings and concludes that time pressure has a positive effect on audit efficiency, which often triggers an unintended negative effect on audit effectiveness.

In a typical audit engagement, auditors should be concerned with both aspects of audit performance - effectiveness and efficiency. Given the high time-pressure audit environment in which audits are typically conducted, limitations on human information processing coupled with advances in information technology ought to lead rational auditors to use whatever means available to help improve audit efficiency and effectiveness. However, as indicated by prior audit research, auditors' primary motivation for relying on decision aids will likely be driven by their desire to be more efficient, which leads to the following hypothesis:

H1: There will be a positive relationship between perceived time pressure and auditors' decision aid reliance.

2.2 Audit Task Complexity

Many of the tasks auditors perform are highly complex and such complexity can have a major impact on audit judgments (Bonner, 1994; Libby, 1985). Several studies in psychology and management have shown that task complexity can have a wide range of effects on judgment and, in general, an increase in task complexity tends to decrease judgment quality (Bonner, 1994).

Several definitions of task complexity have been proposed in the literature, each considering different aspects in their definitions. For example, studies in different domains have looked at whether task complexity is a function of the task itself, or whether it depends on both the task and the person performing the task (Bonner, 1994; Campbell, 1988; Wood, 1986). Studies that believe task complexity is a function of the task alone generally assert that the task complexity is perceived equally by all individuals irrespective of their personal attributes, such as skill or motivation (Bonner, 1994; Campbell, 1998).

Other studies believe that the attributes of the person performing the task can interact with objective task complexity (Bonner, 1994; Campbell, 1998). These studies examined personal characteristics, such as skill and insight, as well as task characteristics, such as the task's mode of representation or the number of processes required to perform the task (e.g. Frost and Mahonev, 1976). Although the predicted effects of task complexity on judgment performance would not differ between these two views, the current study views task complexity as a perception, not an objective state. This definitional view of task complexity assumes that such complexity is an interactive function of objective aspects of the task and personal characteristics of the decision-maker.

The use of decision aids in the decision making process can help improve judgment quality in the presence of complex tasks. Prior research documents a positive relationship between task complexity and decision aid use (Arnold and Sutton, 1998). Decision aid literature also suggests that different types of decision aids are required for tasks of differing complexity (Abdolmohammadi, 1997).

The effect of task complexity on decision making and decision aid reliance has been examined by several researchers in differing domains (e.g. Brown and Jones, 1998; Baron et al., 1996; Masha and Miller, 2001; Hornic and Ruf, 1997). Most research in this area documents a positive relationship between task complexity and decision aid reliance (Arnold and Sutton, 1998). Findings from this line of inquiry also indicate that decision aids are more beneficial for high complexity tasks, as they improve decision accuracy. Finally, information systems and psychology research results suggest that, in an environment of high task complexity, a decision maker tends to rely on the decision aid to improve judgment quality. Extending these findings into an auditing context, since the accuracy of the decision is important, an auditor will tend to search for a smarter way of performing the task if it is highly complex, thus resulting in higher reliance on the decision aid's advice with the objective of becoming more effective. This leads to the following hypotheses:

H2: There will be a positive relationship between perceived task complexity and auditors' decision aid reliance.

2.3 Litigation Risk

Negligence lawsuits are a serious problem facing the auditing profession. Accounting firms are increasingly becoming targets of litigation, reflecting a change in public opinion toward the role of auditors (Jennings et al., 1993; Stice, 1991). Litigation is costly to auditors in several ways. Audit firms not only face potentially huge monetary payments due to litigation, but they must also contend with damaged reputations, which can lead investors to attribute lower quality to the services they provide. As a result of litigation effects, audit firms can be forced to downsize or declare bankruptcy (Palmrose,

1988). Because of the potentially severe deleterious effects of litigation, auditors regularly assess litigation risk in their audit planning process, which helps them align their audit investment with the possibility of audit failure (Stice, 1991).

The level of litigation risk is not constant across all audit engagements, as it varies with client attributes¹, audit firm characteristics², and global litigious environments³. When forming judgments, auditors know that they will be held accountable for the decisions they make (Stice, 1991; Messier et al., 1992). As stated by Ashton et al. (1989, 130), in auditing “because of the environment, the professional auditor must be prepared to justify, document, and take responsibility for his/her judgments and decisions” (Messier et al., 1992). This adds additional pressure on auditors to improve performance and take into consideration the possibility of having to justify their decisions to a supervisor or in court of arbitration or law. In a high litigation engagement, auditors will not only perform additional testing, but will also try to make the most defensible decisions in the eyes of a jury. This decision making process has been referred to by Staw (1980) as “prospective rationality” where individuals know in advance that they may have to defend their decisions to others. In these situations, auditors will try to identify the most defensible position and will devote substantial cognitive effort to do so (Messier et al. 1992).

In order to improve the quality of the audit and provide consistence of such quality, several audit firms have adopted more structured methods of operation (Jennings et al.,

¹ The effectiveness of a firm’s internal control or the financial condition of a firm can affect the likelihood of material misstatements occurring in financial statements leading to a higher risk of litigation.

² The amount of resources available to the auditor or the tenure of the audit/client relationship are factors that can lead to audit failures.

³ Legal environments differ among countries.

1993). One approach to enhance an auditor's decision-making and/or performance in such highly structured environments is to use cost-effective decision aids. Prior decision aid research indicates that the use of these decision aids generally increases the decision accuracy and performance of decision makers (e.g. Benbasat and Nault, 1990; Ashton, 1992), and reduces the likelihood of auditors making inconsistent decisions in similar situations (Jennings et al., 1993). Decision aids may also be used to reduce negative outcomes of litigation (Lowe and Reckers, 2000).

Decision aids provide auditors with a means by which they can reach the same conclusion when met with similar situations at different times (consistency), and reach different conclusions in different situations (distinctiveness). In a legal environment, jurists tend to consider audit decision aids as a form of internal guidance and a surrogate standard of performance provided by accounting firms and they not only look at the size of the error, but also look at the materiality of the auditor's departure from the decision aid in their determination of auditor liability (Jennings et al., 1993). If there is a material misstatement and a large departure from the decision aid, a jury will assess higher liability to the auditor. That is, a judge or jury might feel that the auditor violated a standard leading to an increased perception of culpability and liability (Jennings et al., 1993). On the other hand, if there is little deviation from the audit decision aid (internal guidance), a judge or jury may consider adherence to the decision aid (structured guidance) as a positive signal of the auditor's due diligence and responsibility (Jennings et al., 1993). This suggests that, when faced with high perceived litigation risk, auditors are expected to rely more on a decision aid to be in a better position to defend themselves if faced with litigation.

Several researchers have studied the effect of decision consequences (a proxy for litigation risk) on a user's level of reliance on a decision aid (e.g. Ashton, 1990; and Boatsman et al., 1997). Their results show that the manipulation of decision consequences can affect the level of reliance on a decision aid. Auditors tend to rely on decision aids when there is a higher cost of audit failure (Boatsman et al., 1997). In addition, when a decision aid with a high implicit performance standard is provided, decision makers tend to use it to assist in their decision making processes (Ashton, 1990).

Combining the results of decision aid literature with those of the litigation risk suggests that auditors in a high litigation risk environment will tend to rely more on decision aids than auditors in a low litigation risk environment, as auditors in a high litigation environment are trying to improve and ensure audit effectiveness. This leads to the third hypothesis:

H3: There will be a positive relationship between perceived litigation risk and auditors' decision aid reliance.

2.4 Joint Effects of Time Pressure, Task Complexity and Litigation Risk

Rational auditors will continuously try to improve the effectiveness and efficiency of their performance in an audit engagement. Each of the three factors examined herein (time pressure, task complexity, and litigation risk) creates 'pressure' on an auditor to either improve audit efficiency or audit effectiveness. Assuming that the pressures created by these factors are linear and equally weighted, one can think about such pressures in the form of 'DA reliance motivator units'. While the assumptions of linearity and equal weighting may not be precisely correct, since there is no empirical evidence to the contrary, these assumptions reflect a "first approximation" of how various

combinations of these pressures jointly motivate auditors to perform better through the decision aid reliance.

As discussed in previous sections, when auditors experience a high level of time pressure, they are concerned with completing the audit within the amount of time allowed; in such instances, they will be motivated to improve their performance to gain audit *efficiency*, thereby resulting in one DA reliance motivator unit. When auditors are faced with performing a complex task, they will be concerned with the *effectiveness* of their performance, thereby giving rise to a second motivational unit of DA reliance. Auditors who are faced with high litigation risk will be concerned with the accuracy of their judgment; hence, they also will be motivated to improve their performance to gain audit *effectiveness*, thus reflecting a third motivational unit of DA reliance. The joint and interactive effect of these three variables on auditors' decision aid reliance is examined in the following sections.

2.4.1 Time Pressure and Task Complexity

Time pressure and task complexity are expected to jointly affect decision aid reliance, as the former motivates the auditor to rely on a decision aid to be more *efficient* and the latter to be more *effective*. Byström and Järvelin (1995) show that as the complexity of a task increases, individuals tend to look for other sources to help perform the task. When auditors are faced with performing a complex task under time pressure, the increased pressure resulting from the perceived time pressure and the cognitive overload caused by the perceived task complexity is expected to lead them to search for help, such as a decision aid. This suggests that, in an auditing context where auditors are frequently faced with complex decision-making situations under time pressure, they will

tend to rely on decision aids in their decision making process to improve the *efficiency* and *effectiveness* of their performance. However, assuming that each of the DA reliance motivator units to improve efficiency or effectiveness provides a fairly equal (i.e., additive) incentive to rely on a decision aid, no interaction is expected between the two variables.

2.4.2 Time Pressure and Litigation Risk

When operating under relatively high time pressure, auditors will be mainly concerned with completing their tasks within the time budget allowed. In such a case, they will be motivated to rely on decision aids to gain audit *efficiency*. Auditors faced with high litigation risk will be concerned with the accuracy of their judgment, thus motivated to use decision aids to improve audit *effectiveness*. As with the prior section, assuming that each of the DA reliance motivator units to improve efficiency or effectiveness provides a fairly equal (i.e. additive) incentive to rely on a decision aid, no interaction is expected between these two variables.

2.4.3 Task Complexity and Litigation Risk

An auditor's level of reliance on a decision aid can also be affected by the combined influences of the complexity of the task at hand and the consequences of making a wrong decision (litigation risk). The pressure to rely on a decision aid created by either task complexity or litigation risk arises from the same motivational source—to be more effective. The empirical and theoretical question here is: Do two effectiveness DA reliance motivators exhibit an additive or interactive effect?

There are two ways to consider the impact of two effectiveness motivators. On one hand, as with the prior two sections, one can assume that each of the DA reliance

motivator units to improve effectiveness provides a fairly equal (i.e. additive) incentive to rely on a decision aid, thus, no interaction would be expected between the two variables, as the effect is additive. On the other hand, providing two incentives to improve audit effectiveness might not result in an additive increase in the level of decision aid reliance; thus, the possibility of a competing hypothesis arises.

For example, if auditors are faced with performing an audit in a high litigation risk or high task complexity environment, either source of pressure will motivate them to improve the accuracy of their decisions (i.e. they will have one DA reliance motivator unit to improve audit *effectiveness*). When auditors are simultaneously faced with a second motivator to be more effective (e.g. either high task complexity or high litigation risk), they will again be motivated to increase audit effectiveness (i.e. they will have another DA reliance motivator unit to improve audit *effectiveness*). In either case, adding a second motivator to improve audit effectiveness might not necessarily lead to a higher level of decision aid reliance, as the auditor will already be putting forth extra effort to improve audit effectiveness, including relying on the decision aid. This leads to a possible interaction hypothesis:

H4: Decision aid reliance will be lowest when perceived task complexity and perceived litigation risk are low and highest when perceived task complexity and/or perceived litigation risk are/is high.

2.4.4 Time Pressure, Task Complexity and Litigation Risk

If each DA reliance motivator is additive, there should be no three-way interaction. However, as expressed in H4 above, there is reason to expect a two-way interaction between task complexity and litigation risk, thus giving rise to a possible three-way interaction.

Considering H4 and holding time pressure low (no incentive to be more efficient), one would expect the same result as predicted in H4, as next hypothesized:

H5a: Holding time pressure low, decision aid reliance will be lowest when perceived task complexity and perceived litigation risk are low and highest when perceived task complexity and/or perceived litigation risk are/is high.

Next, assume H4 and hold time pressure high (one DA reliance unit based on *efficiency*). One would expect the same pattern of results as predicted in H4 and H5a, only the levels should be higher due to the constant inducement of time pressure to be more efficient. This leads to the final hypothesis:

H5b: Holding time pressure high, the same decision aid reliance pattern predicted in H5a will obtain; however, the pattern will be significantly higher due to the constant DA reliance motivator of time pressure.

3. Research Method

In order to examine the effect of time pressure, task complexity and litigation risk on auditor's reliance on a decision aid, an experiment was conducted in a controlled environment using software specially designed for the experiment. Computerized automation of the experiment enabled more control over participants and experimental manipulations during task performance. The software provided all experimental information to the participants and allowed for recording of responses during the experiment.

The experiment involved a 2 x 2 x 2 between subjects design. The three independent variables were time pressure, task complexity and litigation risk. Each factor was manipulated between-subjects at two levels (high or low), resulting in eight treatment conditions.

3.1 Pilot Testing

Three pilot tests were conducted to develop and refine the test instruments. The first pilot test was conducted during a research seminar offered in a large research university in the Netherlands. Eighteen Ph.D. students from various European universities participated in the pilot test. The aim of the first pilot test was to examine the task complexity manipulation in order to make any necessary changes to the instrument. Based on the first pilot test, several changes were made to the test instrument, mainly to lower the complexity of the ‘high task complexity’ materials, as the complexity was perceived to be too high.

A second pilot test was conducted to determine the mean amount of time it took participants to complete the high and low complex tasks, and examine the effectiveness of the task complexity and litigation risk manipulations. Twenty-one audit seniors and managers from a Big-4 public accounting firm in the United States participated in the pilot test. The results of the second pilot test indicated an effective manipulation of the perceived task complexity and perceived litigation risk variables, and made possible the determination of “perceived time pressure” for the next pilot test.

The first two pilot tests used paper-based materials. In order to provide more experimental control during the administration of the experiment, a computerized version of the test instrument was developed. The third pilot test also determined the effectiveness of the perceived time pressure manipulation in the high and low task complexity conditions, and tested the computerized version of the main experiment. Twenty-two audit seniors and managers from a Big-4 public accounting firm in the United States participated in this pilot test. In the high time pressure condition, the

participants were given a time limit calculated by subtracting two standard deviations from the mean completion time to perform the task, as determined in the second pilot test; participants in the low time pressure condition were given a time limit calculated by adding two standard deviations to the mean completion time to perform the task. Results of time pressure manipulation check questions revealed that the participants did perceive high time pressure and low time pressure in the appropriate task complexity conditions. Also, the software worked as planned on the firm's network.

3.2 Task

Participants were provided with a set of information containing instructions and case materials. The instructions emphasized the importance of their participation, and made clear that their responses would be strictly confidential and be used solely for the purpose of this study. Participants were also provided with information about the time allowed to perform the task. This was done to facilitate the manipulation of high (low) time constraint, as well as perceived time pressure.

The case material described a large manufacturing corporation in which accounts receivables represent a significant percentage of current assets. Participants were provided with management's estimate of the allowance for uncollectible accounts and the aging of accounts receivable schedules for the previous five years. They were also told that management and the audit committee of the board of directors believe that management's estimate fairly represents the amount of uncollectible accounts at the end of the year and that both management and the audit committee are reluctant to change the allowance amount. After reviewing the case materials, participants were asked to provide their estimate of the dollar amount of uncollectible accounts at the end of the year and to

declare the amount of year-end adjusting journal entry they would require of management, if any. Embedded within the case materials, were manipulations of time pressure, task complexity and litigation risk, as more fully explained in upcoming sections.

All participants were then provided with the advice of a decision aid. The decision aid was designed to assist in evaluating the reasonableness of the allowance for doubtful accounts. Participants were told that using the decision aid output was intended to be advisory only. After reviewing the decision aid's advice, and given an option to re-examine the client's financial information, participants provided a second assessment of the dollar amount of uncollectible accounts and year-end adjusting journal entry recommendation. They were fully aware that they did not have to change their initial responses, or they could change the initial amounts in any direction or magnitude they deemed appropriate.

3.3 Procedure

The experimental software was installed on the intranet and extranet servers of each of the participating public accounting firms. The experiment was simultaneously run in all participating firms for a period of one week. At the beginning of the experiment, each participant was randomly assigned one of the eight between-subject treatments. All participants in each condition were presented with a set of instructions on their screens, followed by the case materials. The experiment software controlled the amount of time allowed to complete the task and recorded the participants' responses into an Access database. Upon the completion of the task, participants were asked to fill out a post-experiment questionnaire.

3.4 Experimental incentives

Participation in the experiment was voluntary. A fixed financial incentive system was used to encourage participation. Participants were informed that \$50 would be donated to the charity of their choice for their participation.

3.5 Experimental variables

The following subsections explain the independent variables, decision aid treatment, and dependent variable in more detail.

3.5.1 Independent Variables

Time Pressure

Researchers studying time pressure typically measure such pressure by allocating specific time to perform a task (e.g. Ahituv et al., 1998). However, a distinction needs to be made between *absolute time* and *time pressure* (Fisher et al., 2003). Fisher et al. (2003, 174) define a time constraint as “a specific allotment of time for making a decision, while time pressure is a subjective reaction to the amount of time allotted.” Additionally, Svenson and Edland (1987) explain that individuals experience time pressure whenever they perceive the time available to complete a task as being shorter than what would normally be required to complete the task. Time pressure may be felt by some individuals in an objectively high time pressure condition, while others might not feel time pressure under the same condition (Fisher et al., 2003). Since the participants’ reliance on the decision aid’s advice will be affected not only by the amount of time given to perform the task but also by their perception of time pressure, participant’s *perceived time pressure* was used to determine the extent to which the time pressure manipulation was successful.

Task Complexity

Task complexity was varied by manipulating the clarity of input, which has been defined and used by many researchers as a manipulation of task complexity (e.g. Moriarty, 1979; Payne et al., 1990a, 1990b, 1992; Bonner, 1994). In the current study, task complexity was manipulated at two levels, high and low. In the high task complexity condition, participants were presented with the financial ratios and accounts receivable aging schedules in narrative form. For the low task complexity conditions, participants were provided with exactly the same information; however, the financial ratios and accounts receivable aging schedules were presented in tabular form.

Litigation Risk

Litigation risk is manipulated at two levels, high and low. In the high litigation risk condition participants were given information about the outcomes of failing to reach the appropriate judgment regarding the allowance for doubtful accounts and the possible legal consequences. In the low litigation risk condition, participants were given similar information; however, the probability of being sued and the consequences of being sued will be only a fraction of the high litigation case.

3.5.2 Decision Aid

To measure the effects of a decision aid on participants' judgment decisions, the output of a decision aid was provided after participants provided their initial judgment. They were then asked to provide their final judgment. The participants were told that the decision aid is provided to assist them during their audit. In addition, they were told that the output of the decision is intended to be advisory only and that the ultimate decision regarding the estimate of the allowance for uncollectible accounts is their judgment call.

Information on what the decision aid analyzed was provided before providing its estimate of the allowance for uncollectible accounts. Participants were told that the decision aid was correct 8 out of 10 times in the past, yielding an 80% reliability score. The reliability of 80% was chosen as prior decision aid reliance research showed that providing participants with a decision aid with very low reliability leads to non-reliance, as participants feel that they will always perform better than the decision aid. Prior research also indicated that providing participants with a decision aid that is highly reliable (e.g. 95% to 100%) leads to over-reliance, as participants feel that using the decision aid will yield correct results every time. Therefore, to measure the effects of the decision aid on judgment decisions, a reliability of 80% is commonly used in decision aid reliance research.

3.5.3 Dependent Variable

The dependent variable in this study reflects the level of reliance on the decision aid, as used by Hayes (2002), wherein he examined a measure of reliance based on the amount the participants changed their prediction to agree with the decision aid's advice. This measure shows how much the decision aid's advice influenced the participant's final response. It is calculated as follows (range from 0.00 to 1.00):

Decision Aid Reliance =

$$\frac{(\text{Participant's final Recommended Adj} - \text{Participant's initial Recommended Adj})}{(\text{Decision aid's advice} - \text{Participant's initial Recommended Adjustment})}$$

By comparing the difference between the participant's initial and final recommendations to the difference between the decision aid's advice and the participant's initial recommendation, the reliance function is able to show how much the decision aid's advice influenced the participant's final recommendation. The participant's

recommended adjustment, as opposed the participant’s estimate of uncollectible accounts, was used in the reliance function as it took into account not only how the decision aid affected their estimate of the allowance for uncollectible accounts but also the effect it had on their recommended adjustment for uncollectible accounts.

4. Results

4.1 Participants

A total of 235 auditors, including 203 seniors and 32 managers from two of the Big 4 public accounting firms participated in the study. Participants worked in various offices of these two firms located in five large cities in the United States. The mean (median) age range of the participants was 31 to 40 (31 to 35) years, with an average of 5.11 years of experience. The participants included 89 male participants and 146 female participants.⁴ Descriptive statistics on mean (standard deviation) decision aid reliance scores are shown on Table 1.

Insert Table 1 about here

⁴ Tests of sample equivalence indicated that age, gender and experience did not significantly differ among treatments. In addition, a regression model was run to examine the relationship between age, gender, experience or risk propensity and decision aid reliance. No significant relation was found among treatment conditions; therefore, these variables were not included as covariates in the hypotheses testing.

4.2 Hypotheses testing

An ANOVA⁵ model was used to test the statistical significance of differences among means.⁶ In addition, non-parametric Mann-Whitney and the Kruskal-Wallis tests were conducted to support the results obtained using the ANOVA.

The results of the ANOVA analysis indicated significant main effects on the three variables of interest and the three-way interaction (Table 2). As well, the Kruskal-Wallis test indicated that the means of at least two of the treatment conditions were significantly different ($\chi^2 = 202.505, p = 0.00$). Results of a Bonferroni multiple comparison test ($p = .05$) is shown on Table 2, panel B.

Insert Table 2 about here

The first hypothesis (H1) relates to the effects of time pressure on auditors' reliance on decision aids. It predicts that auditors will rely more on decision aids when working under high perceived time pressure. A univariate test on reliance indicated that perceived time pressure was significant ($p = 0.00$). Comparison of the group means revealed that participants in the high time pressure treatment relied more on the decision aid (mean = 0.73, $\sigma = 0.20$) than participants in the low time pressure condition (mean = 0.31, $\sigma = 0.20$). In addition a Mann-Whitney test indicated a significant mean difference between the two groups (Mann-Whitney $U = 1117, p = 0.00$). Therefore, H1 was supported.

⁵ The assumptions of independence, normality, and homogeneity were examined and deemed within acceptable tolerances. Recognizing that one of the assumptions of ANOVA is interval scaling, differences in the DA reliance metric between and across treatments will not be compared on an absolute basis; rather, they will be interpreted as ordinal (i.e., either significantly higher or lower).

⁶ Statistical testing of manipulation check items indicated the successful manipulation of the three factors.

The second hypothesis (H2) deals with the effect of task complexity on auditors' reliance on decision aids. It predicts that auditors will rely more on decision aids when they perceive the task to be highly complex to accomplish. A univariate test on reliance indicated that perceived task complexity was significant ($p = 0.00$). Comparison of the group means revealed that participants in the high task complexity treatment relied more on the decision aid (mean = 0.60, $\sigma = 0.28$) than participants in the low time pressure condition (mean = 0.43, $\sigma = 0.28$). In addition a Mann-Whitney test indicated a significant mean difference between the two groups (Mann-Whitney $U = 4513.5$, $p = 0.00$). Therefore, H2 was supported.

The third hypothesis (H3) relates to the effects of litigation risk on auditors' reliance on decision aids. It predicts that auditors will rely more on decision aids when they perceive litigation risk to be high, as compared to low. A univariate test on reliance indicated that perceived litigation risk was significant ($p = 0.00$). Comparison of the group means revealed that participants in the high litigation risk treatment relied more on the decision aid (mean = 0.66, $\sigma = 0.25$) than participants in the low litigation risk condition (mean = 0.37, $\sigma = 0.26$). In addition a Mann-Whitney test indicated a significant mean difference between the two groups (Mann-Whitney $U = 2966.5$, $p = 0.00$). Therefore, H3 was supported.

Hypothesis H4 deals with a possible interactive effect of litigation risk and task complexity. Specifically, H4 predicts that decision aid reliance will be lowest when perceived task complexity and perceived litigation risk are low, and highest when perceived task complexity and/or perceived litigation risk are/is high. The results of the ANOVA indicate that the interaction between litigation risk and task complexity is not

significant ($p = 0.49$). Interestingly, this analysis suggests an additive effect of the two *effectiveness* motivators. Therefore, H4 is not supported.

The final two hypotheses predict possible joint effects among all three pressure sources. The ANOVA results presented in Table 2 indicate a significant three way interaction ($p = 0.006$). In order to further analyze and determine the nature of the interaction, two additional ANOVA models were run, one holding time pressure high, and the second holding time pressure low. The results of the ANOVA models are presented in Table 3.

Insert Table 3 about here

When holding time pressure low, there is no significant interaction between litigation risk and task complexity ($p = 0.11$). Comparison of the group means indicated that participants in the high task complexity, high litigation risk treatment had the highest level of reliance (mean = 0.55, $\sigma = 0.12$). The lowest level of reliance was in the low task complexity, low litigation risk treatment (mean = 0.08, $\sigma = 0.04$), with the remaining two group means falling between these two levels. The Bonferroni multiple pairwise comparison test (Table 2 Panel B) indicated that all four of the means were significantly different from each other ($p = 0.05$). In addition Mann-Whitney tests indicated significant differences between the groups ($p = 0.00$). Hence, H5a is not supported.

When holding time pressure high, the ANOVA analysis indicates a significant interactive effect between litigation risk and task complexity ($p = 0.028$). Although the highest level of reliance was in the high litigation risk high task complexity treatment

(mean = 0.92, σ = 0.08) and the lowest level of reliance was in the low litigation risk low task complexity treatments (mean = 0.47, σ = 0.17), with the two remaining group means falling in between these two levels, and they were significantly different (Table 2), the results show that the effects of the two factors is not additive. Therefore, H5b is partially supported.

5. Concluding Remarks

The purpose of this study is to examine whether auditor reliance on a decision aid depends on the level of perceived litigation risk arising from the client, perceived time pressure imposed by a budget constraint, and perceived complexity of the audit task. A between-subjects experimental design was used to test the hypotheses. The three independent variables were time pressure, task complexity and litigation risk. Each of these were manipulated at two levels (high and low). The dependent variable was the level of auditor's reliance on a decision aid.

The results of this study show a positive relationship between perceived time pressure, perceived task complexity and perceived litigation risk and auditors' reliance on a decision aid. These results confirm the findings of prior information systems and psychology studies examining the effects of task complexity on decision aid reliance, and further explain auditors' decision aid reliance behavior when faced with time pressure or litigation risk.

Auditors will tend to rely more on decision aids in their decision making process when working under time pressure. Prior decision aid research documents that using decision aids when making decisions under time pressure not only improves the accuracy of decisions, but also enhances the efficiency of the decision making process (Kumar,

1997; Hayne and Smith, 1996; Chu and Spiers, 2003; and Arnold et al., 2000). Therefore, given the importance of decisions made by auditors, these results are expected as auditors will tend to rely more on decision aids to improve the efficiency of their judgment decisions.

The positive relationship between litigation risk and auditors' decision aid reliance behavior was also expected. Prior research studying the effects of decision consequences on a user's level of reliance on a decision aids document a positive relationship between decision consequences and decision aid reliance (e.g. Arkes et al., 1986; and Boatsman et al., 1997). In an auditing engagement, an auditor's judgment decisions are important. When faced with a high risk of litigation, the consequences of making incorrect decisions increases. Therefore, in these situations auditors will rely on decision aids to increase the effectiveness of their judgment decisions. Additionally, when a law suit is filed, a judge or jury may consider adherence to a decision aid (structured guidance) as a positive signal of the auditor's due diligence and responsibility (Jennings et al., 1993). Thus, when faced with high perceived litigation risk, auditors are expected to rely more on a decision aid to be in a better position to defend themselves if faced with litigation.

The study also finds that the combination of any of these factors leads to a higher level of reliance. These results contradict the findings of Ashton (1990), who showed that increasing pressures to improve performance lead to decreased reliance on a decision aid. However, the results obtained by his study are explained due to the tournament-style incentive scheme used and the relatively low face validity (50%) of the decision aid he used in his experiments. By contrast, the current experiment used a fixed incentive system and a decision aid with relatively high face validity (80%).

The current study also demonstrates that the effects of combining these factors were additive in all but one combination; that is, whether litigation risk and task complexity interacted depended on the level of time pressure the auditors faced. When faced with high time pressure, the presence of litigation risk when performing a highly complex task resulted in an interaction between these two factors. These results can be explained since each of the factors arises from a different source of pressure for an auditor to rely on a decision aid. Both litigation risk and task complexity motivate auditors to rely on a decision aid to improve the *effectiveness* of their decision aid, while time pressure motivates auditors to rely on a decision aid to improve the *efficiency* of the audit. When faced with the risk of litigation while performing a task under high time pressure, auditors are motivated to rely on the decision aid to improve both the effectiveness and efficiency of their performance. Adding another motivator to improve effectiveness resulted in a small, but not equivalent, increase in the level of decision aid reliance. Thus, the marginal benefit from increasing the level of reliance, therefore, decreases as additional pressure is induced.

This study, however, has some limitations. As in any controlled experiment, the experimental environment and the audit tasks might not fully reflect real life conditions. This will have an effect on the generalizability of the results beyond the experimental setting. However, litigation risk, time pressure, and task complexity allows us to draw causal inferences through theory to other settings, times and participants. In addition, using computer software, though necessary for control during the experiment, might have some unknown effect on participants' behaviors.

The importance of this study stems from the need to understand the effects of *pressure inducers* created by time pressure, task complexity and litigation risk on auditors' decisions to incorporate the advice of a decision aid into their the decision making processes, and in-turn, on audit judgment. Study findings are particularly important in light of the increased litigation cost in the auditing industry. Although some research has examined the effect of time pressure and task complexity on auditors' use of decision aids, this study is the first to investigate the joint effect of litigation risk and these sources of pressure on the level of auditors' reliance on decision aids.

Findings from this study can help provide further explanation of auditors' behaviors with respect to reliance on decision aids and open the door for other future research in this area. For instance, future research might replicate the current study using different measures of auditor's reliance on decision aids. Further, this study limits the manipulation of independent variables to two levels (high and low); other studies might try to examine the hypothesized relationships using more than two levels of litigation risk and time pressure. Another interesting area of future research is to try to measure the amount of pressure at which an auditor changes his/her decision from 'non-reliance' to 'reliance' on a decision aid. Finally, although this study theoretically infers the motivation for relying on a decision aid (to improve audit effectiveness or efficiency), future studies could delve more deeply into such motivation.

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Table 1: Descriptive Statistics: Mean (Standard Deviation) Responses

Panel A: Low Time Pressure

Task Complexity	Litigation Risk		<i>Main Task Complexity Effect</i>
	Low	High	
Low	0.08 (0.04)	0.34 (0.10)	0.22 (0.15)
High	0.22 (0.10)	0.55 (0.17)	0.38 (0.20)
<i>Main Time Pressure Effect</i>	0.15 (0.11)	0.45 (0.15)	

Panel B: High Time Pressure

Task Complexity	Litigation Risk		<i>Main Task Complexity Effect</i>
	Low	High	
Low	0.47 (0.12)	0.81 (0.08)	0.63 (0.22)
High	0.69 (0.10)	0.92 (0.12)	0.81 (0.16)
<i>Main Time Pressure Effect</i>	0.58 (0.18)	0.87 (0.11)	

Table 2: ANOVA and Multiple Comparisons Results

Panel A: Tests of Between Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	61.059	1	61.059	5111.498	.000
TP	10.528	1	10.528	881.369	.000
LR	4.933	1	4.933	412.936	.000
TC	1.716	1	1.716	143.641	.000
TP x LR	.002	1	.002	.128	.721
TP x TC	.001	1	.001	.117	.732
LR x TC	.006	1	.006	.489	.485
TP x LR x TC	.090	1	.090	7.562	.006
Error	2.712	227	.012		

Panel B: Bonferroni Multiple Comparisons

Treatment	LTP LLR LTC	LTP LLR HTC	LTP HLR LTC	LTP HLR HTC	HTP LLR LTC	HTP LLR HTC	HTP HLR LTC	HTP HLR HTC
LTP/LLR/LTC								
LTP/LLR/HTC	X							
LTP/HLR/LTC	X	X						
LTP/HLR/HTC	X	X	X					
HTP/LLR/LTC	X	X	X	NS				
HTP/LLR/HTC	X	X	X	X	X			
HTP/HLR/LTC	X	X	X	X	X	X		
HTP/HLR/HTC	X	X	X	X	X	X	X	

TP = Time Pressure

TC = Task Complexity

0.05 level.

LR = Litigation Risk

LLR = Low litigation risk

LTP = Low time pressure

LTC = Low task complexity

HLR = High litigation risk

HTP = High time pressure

HTC = High task complexity

X = The mean difference is significant at the 0.05 level.

NS = The mean difference is not significant at the

Table 3: Tests of Between Subjects Effects

Panel A: Holding Time Pressure Low

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	10.397	1	10.397	1092.432	.000
LR	2.544	1	2.544	267.270	.000
TC	.904	1	.904	94.988	.000
LR x TC	.025	1	.025	2.629	.108
Error	2.712	113	.010		

Panel B: Holding Time Pressure High

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	61.396	1	61.396	4277.836	.000
LR	2.390	1	2.390	166.517	.000
TC	.813	1	.813	56.636	.000
LR x TC	.071	1	.071	4.970	.028
Error	1.636	113	.014		

Dependent Variable: Reliance

TC = Task Complexity

LR = Litigation Risk