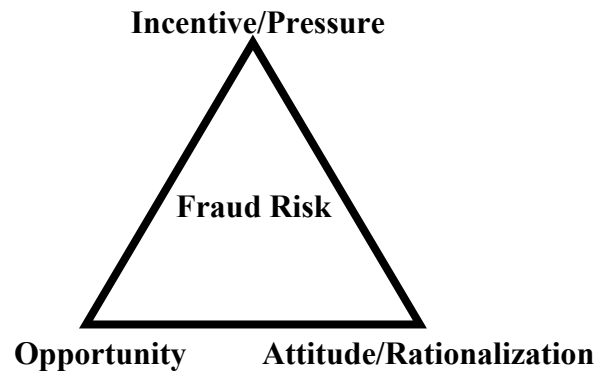


# **An Analysis of the *Fraud Triangle***



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# AN ANALYSIS OF THE FRAUD TRIANGLE

## ABSTRACT

The concept of a “Fraud Triangle” is introduced to the professional literature in SAS No. 99, *Consideration of Fraud in a Financial Statement Audit*. The Fraud Triangle consists of three conditions generally present when fraud occurs: Incentive/Pressure, Opportunity, and Attitude/ Rationalizations. Input from forensic experts, academics and others consistently show that evaluation of information about fraud is enhanced when auditors evaluate in the context of these three conditions. To examine the impact of the fraud triangle on the audit process, this paper develops an evidential network that has two major sub-networks: one to capture risk and evidential relationships for a conventional financial statement audit and the other to capture the risk and evidential relationships for fraud risk assessment. These networks use the Belief Functions approach to express the uncertainties involved in the evidence in a financial statement audit. The results of the analyses support the concept of the fraud triangle in that the three components and the relationships between those components are shown to have a substantial impact on audit risk.

# AN ANALYSIS OF THE FRAUD TRIANGLE

## INTRODUCTION

The main objectives of this research are to present a baseline model of audit risk that incorporates the risk of fraud; to determine reasonable combinations of audit evidence for this model that will result in an assessment of audit risk of approximately 0.05 or less; and most importantly, to enhance this model to incorporate the requirements of a recent Exposure Draft (AICPA 2002) intended to modify SAS No. 82. The characteristics of this enhanced model then are formally evaluated. These models are based on prior research into evidential audit networks (Srivastava and Shafer 1992), into audit planning (Mock et al. 1998) and into fraud risk assessment (Turner et al. 2002).

To achieve these objectives, this paper develops an evidential network that has two major sub-networks: one to capture risk and evidential relationships for a conventional financial statement audit and the other to capture the risk and evidential relationships for fraud risk assessment. Given that prior research (Turner et al. 2002) has investigated the basic features of this type of framework, this paper investigates more complex relationships between the main factors that seem to affect fraud and audit risk. Specifically, the following research questions are investigated in this paper:

RQ1: What is the effect on Audit Risk of an interaction between Incentives and Management Integrity?

RQ2: What is the effect on Audit Risk of interactions between Incentives and Management Integrity and Opportunities and Management Integrity?

RQ3: What is the effect on Audit Risk of Modified Audit Procedures?

## BACKGROUND AND PRIOR RESEARCH

Audit risk is defined in SAS No. 47, *Audit Risk and Materiality in Conducting an Audit*, as “The risk that the auditor may unknowingly fail to appropriately modify his or her opinion on financial statements that are materially misstated.” (AICPA 1984, ¶02). Audit risk is represented in the form of a model in the SAS and is decomposed into three separate risks: inherent risk, control risk, and detection risk. This model is designated as the Audit Risk Model (ARM).

To increase awareness of the possibility of fraud, SAS No. 82, *Consideration of Fraud in a Financial Statement Audit* (AICPA 1997), was issued in February 1997. While not modifying the basic ARM, it provides expanded operational guidance on the auditor’s consideration of material fraud in conducting a financial statement audit. Effective for audits of financial statements for periods ending on or after December 15, 1997, SAS No. 82 clarifies but does not increase the auditor’s responsibility to detect fraud. That responsibility still is framed by the key concepts of materiality and reasonable assurance (Mancino 1997).

Under SAS No. 82, auditors are required in every audit to specifically assess the risk of material misstatement of the financial statements due to fraud and to continue to assess that risk throughout the audit. SAS No. 82 describes two types of fraud that may result in financial statement misstatements: fraudulent financial reporting and misappropriation of assets. For fraudulent financial reporting, SAS No. 82 identifies three categories of risk factors: management’s characteristics and influence over the control environment, industry conditions, and operating characteristics and financial stability. For misappropriation of assets, two categories are identified: susceptibility of assets to

misappropriation and controls. For each of the five categories, examples of situations that might indicate fraud are provided. If any risk factors are identified, the auditor is required to determine if planned audit procedures need to be modified.

When SAS No. 82 was issued, the Auditing Standards Board (ASB) indicated that once the SAS has been in use for two busy seasons, it would be evaluated as to how well it had accomplished its objectives and that any further steps that need to be taken would be identified. This led to five research projects funded by the AICPA and a number of other studies aimed at increasing our understanding of the risk of fraud and its effects on audit risk. The resulting research clearly was helpful in providing insights about the effects of SAS No. 82, including identifying specific issues for further research on fraud deterrence and detection.

In February 2002, after evaluating the impact of SAS No. 82, the ASB released an Exposure Draft (ED) intended to expand required audit procedures to address material financial statement fraud. The ED emphasized considering a client's susceptibility to fraud, regardless of the auditor's past experience with the entity or prior beliefs about management's honesty and integrity. Among others, the new standard would require that:

- Auditors must broaden the range of information they use to assess the risks of material misstatement due to fraud, beyond the fraud risk factors provided in SAS No. 82.
- Auditors must consider management's programs and controls to address risks and determine whether such programs and controls will mitigate or exacerbate the identified risks.
- Auditors must develop an appropriate response for each fraud risk identified.

Montgomery, et al. (2002) provide an analysis of the requirements of the ED and introduce the concept of “The Fraud Triangle” consisting of three conditions generally present when fraud occurs: Incentive/Pressure, Opportunity, and Attitude/Rationalizations. Input from forensic experts, academics and others consistently showed that evaluation of information about fraud was enhanced when auditors considered it in the context of these three conditions.

The ED emphasizes obtaining a broader range of information to serve as the foundation for an assessment that goes beyond considering the fraud risk factors provided in SAS No. 82. The various sources of information—the audit team discussion, inquiries of management and others, consideration of fraud risk factors, the results of planning analytical procedures, information from the client acceptance or continuance process and from reviews of interim financial statements—all feed into the auditor’s evaluation of fraud risks.

### **Audit Risk and Fraud Risk**

Subsequent to the issuance of SAS No. 47, several different approaches to developing a model of audit risk and of the ARM have been presented. For example, Srivastava et al. (1996) use a belief-functions framework to model the audit planning and evaluation process for accounts receivable for a health care unit. In doing so, they demonstrate the viability of Auditor’s Assistant, an expert system shell to automate the belief functions propagation in networks. In addition, sensitivity analyses were performed to determine the impact of the strength of evidence as a function of location in the network, and to investigate the effect of variability in the input strengths on the overall belief on each variable in the network (Srivastava and Lu 2002).

Dutta et al. (1998) examine the ARM using a belief-function framework that considers the risks faced by auditors due to random errors, defalcations (employee fraud) and management fraud. They consider two cases. In the first, they consider only affirmative items of evidence and derive an analytical formula for audit risk. In the second, they consider mixed items of evidence (both affirmative and negative), which models the situation more frequently faced by auditors. They demonstrate that a serious underestimation of audit risk can occur if the ARM is used without specifically considering the risks associated with management fraud.

Mock, et al. (1998) examine the feasibility of a belief-function approach in assisting auditors in developing a risk-adjusted program plan. Their findings indicate that after initial training, the output values of the belief-function model accurately reflect the views of an audit partner regarding the assurance obtained on the engagement in testing the accounts receivable area. Further, sensitivity analyses indicate that output values are insensitive to the use of a categorical scale to elicit beliefs rather than a numerical scale. Since auditors customarily use categorical scales in practice (e.g., high, medium, or low risk), this finding suggests that the belief-function approach would be easier to use than a scale based on probability estimates. Finally, sensitivity analyses revealed that the model can be used in the audit program planning or evaluation phases to assess the assurance provided by a given test or set of tests in attaining a cost-effective engagement.

Riahi-Belkaoui and Picur (2000) present a general framework to be used for identifying those situations most conducive to fraud in the accounting environment. The framework relies on models and theories from criminology including the conflict and consensus approaches, the ecological theory, cultural transmission theory and anomic

theory. The framework calls for companies to identify those situations most conducive to fraud, reevaluate their ethics programs and strengthen their internal controls.

In a study that this research extends, Turner et al. (2002) develop a framework that explicitly considers fraud risk within the audit risk model. The framework is based on an evidential network that has two major sub-networks: one to capture risk and evidential relationships for a conventional financial statement audit and another to capture the risk and evidential relationships for SAS No. 82 fraud risk assessment.

Turner et al. (2002) test the framework by considering and evaluating four audit cases. Two of these use case data taken from actual case studies of the implementation of SAS No. 82 (Mock and Turner 2002). The actual cases provide evidence of fraud-risk factors that were identified in actual audit engagements and information on the audit team's decisions concerning audit procedures that were modified to address the identified fraud risk factors. The analysis shows that, in one of these cases, the audit program changes seem to properly reflect the identified audit risks. In the other, the audit program adjustments do not seem effective in addressing identified fraud risks.

### **Evidential Reasoning And Belief Functions**

The second broad area of research we will review briefly is research into evidential reasoning and evidential modeling. In auditing, evidential reasoning relates to issues of evidential evaluation, risk assessment and belief formulation. There are two major issues to deal with in risk assessment and belief formulation. The first deals with the framework that can be used to express and measure the risk, uncertainty and ambiguity present in an audit. Shafer and Tversky (1985) describe this as a process of choosing a "formal language" or "semantics" to express the requisite uncertainties.

There are many frameworks and formal languages that can be used such as those based on probability theory, fuzzy logic, or belief functions (Srivastava and Mock 2002). Although these frameworks have different tradeoffs, we believe the use of Belief Functions is appropriate to express the uncertainties involved in the evidence in a financial statement audit. In the evidential network approach under Belief Functions, items of evidence are combined using Dempster's rule of combination. We have used the computer program "Auditor's Assistant" (Shafer et al. 1988) and Excel spreadsheets to draw the evidential network and to perform our analyses.

### **BASELINE MODEL OF AUDIT RISK**

To assess how the formal fraud risk assessments required by SAS No. 82 and the ED affect financial statements audits, we begin with a pre-SAS No. 82 baseline ARM model as depicted in Figure 1. In general, there are three steps involved in developing an evidential model for a financial statement audit engagement:

- 1) identifying the relevant variables of interest in the audit—in this case these variables consist of various audit assertions and sub-assertions;
- 2) identifying the relationships among assertions and sub-assertions; and
- 3) identifying items of evidence pertinent to the assertions and sub-assertions.

The three boxes with rounded corners in our model represent the three primary assertions and sub-assertions of interest: the financial statements are fairly presented; there are no material misstatements due to errors; and there is no material fraud or misappropriation of assets. The boxes with square corners represent items of evidence

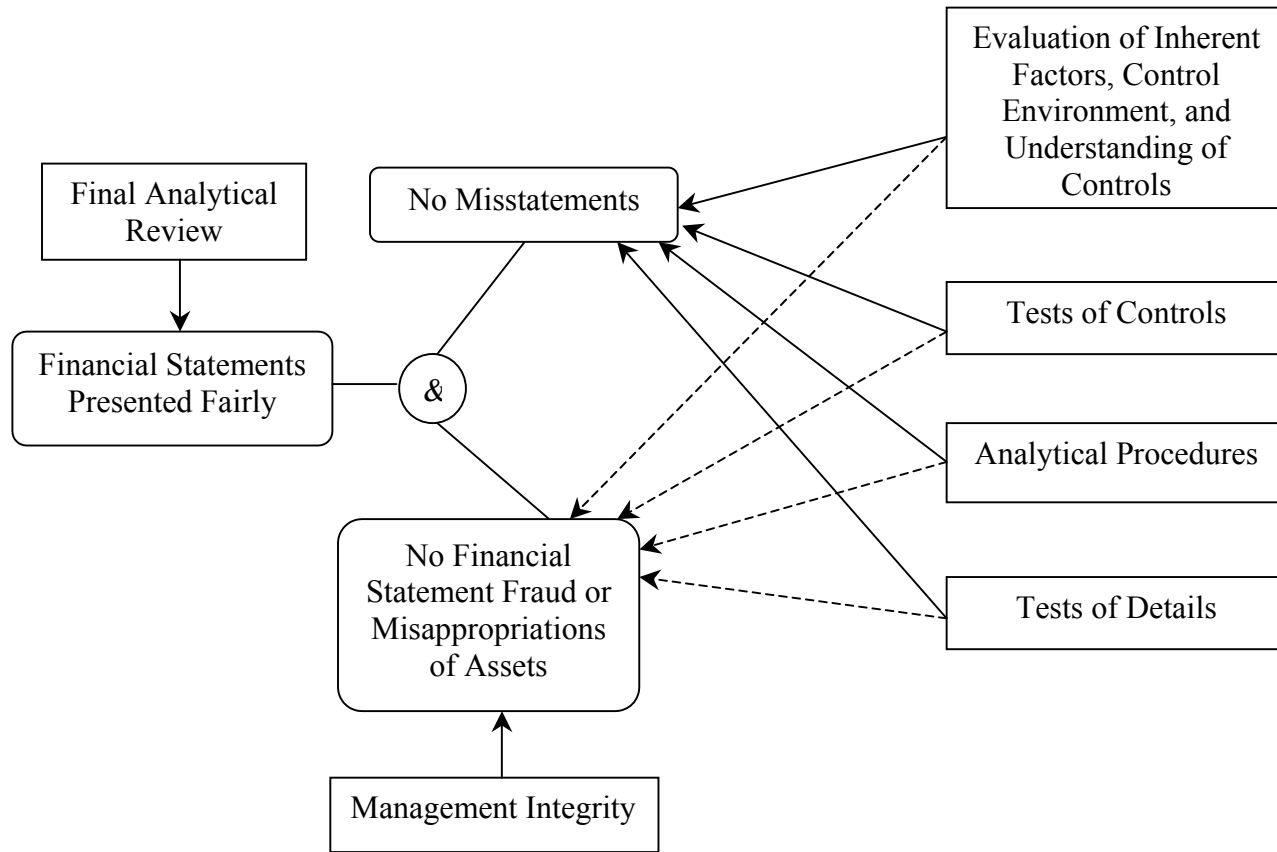
obtained during the audit. These are linked to the corresponding assertion(s) to which they pertain.

As a first step, we specify in Figure 1 relevant financial statement assertions pertinent to the audit engagement. The resulting generic model consists of one assertion, ‘Financial Statements Presented Fairly’, and two sub-assertions: ‘No Misstatements’, and ‘No Financial Statement Fraud or Misappropriations of Assets’.

The second step in developing the evidential model is to establish logical relationships among the various assertions and sub-assertions. In Figure 1, an ‘AND’ relationship is used between the main financial statement assertion that the financials are presented fairly and the sub-assertions. The ‘AND’ relationship appears to be logical in many auditing contexts. For example, it can be argued that the financial statements are free from material misstatements only when there is no misstatement due to fraud and defalcations *and* when there are no material misstatements due to unintentional misstatements.

The last step in developing the model is to identify relevant sources of evidence, i.e., the audit procedures relevant to various assertions and sub-assertions. The boxes with square corners in Figure 1 represent various sources of evidence and the line connecting an item of evidence to an assertion or sub-assertion implies that the evidence is relevant to that particular assertion or sub-assertion. Although traditional audit procedures are not designed to specifically detect fraud or misappropriations of assets, such procedures do provide some degree of support that fraud or misappropriations are not present. While the model makes no distinction mathematically, it is important to note that the primary objectives of traditional procedures relate to discovering unintentional misstatements

**Figure 1**  
**Baseline Model (SAS No. 47)**



NOTE: Solid lines with arrowheads connect stronger evidence to assertions. Dashed lines with arrowheads connect weaker evidence to assertions.

rather than fraud or misappropriations. To emphasize this difference, the evidential links to the 'No Misstatements' assertion are shown as solid lines with arrowheads, representing stronger evidence regarding an assertion, and the evidential links to the 'No Financial Statement Fraud or Misappropriations of Assets' assertion are shown as dotted lines with arrowheads, representing relatively weaker evidence.

When an item of evidence pertaining to an assertion or sub-assertion is evaluated, the assessed belief can be either for, against, or both for and against the corresponding assertion or sub-assertion. One minus the total of beliefs for and against an assertion represents the level of unassigned belief, which is the level of ambiguity remaining given the evidence that is available.

For instance, the values (0.4; 0.1) in an evidence node imply that after evaluating a specific type of evidence, the auditor believes that a 0.4 level of support, on a scale of 0 to 1, is provided in favor of the assertion that the financial statements are fairly stated and 0.1 is provided for the assertion that the financial statements are materially misstated. The unassigned belief, or ambiguity then is 0.5.

Similarly, numbers in an assertion or sub-assertion node represent, respectively, an overall (having combined all the evidence in the evidential diagram) level of support in favor of and against the assertion. In practice, auditors may not express uncertainties in terms of numerical values, but may use discrete scales such as "high" or "low" risk. Although continuous values may be elicited to quantify these beliefs, discrete values may be obtained and used (e.g., high, medium, or low control risk). Prior research has shown that elicitation using discrete scales may lead to greater acceptability and ease of use among auditors than continuous probability scales (Mock et al. 1998).

## **Instantiation and Analysis of the Baseline Model**

To analyze the Figure 1 model, we need to assign values to the evidential nodes and then calculate the effects of such evidence on the various assertions in the model. In the following section we use Auditor's Assistant (Shafer et al. 1988) to aggregate the evidence and analyze the findings.

The starting point in analyzing the model is to estimate what the evidence obtained from the audit activities implies about the various assertions. The relationship included in Figure 1 indicates to which assertion or assertions each item of evidence relates directly. For example, evidence obtained from 'Tests of Controls' is directly relevant to the assertion 'No Misstatements'.<sup>1</sup> If tests of controls indicate that accounting controls are effective, the auditor may believe that the likelihood of material misstatements is reduced substantially and assign a moderate value, i.e. 0.5, as the strength of evidence provided by the evaluation of the controls.

Table 1 shows the assumed strength of evidence from each source used to analyze the baseline case. For example, the evidence provided by the tests of controls is assumed to provide 0.5 level of confidence on a scale of zero to 1.0 that there are no material misstatements in the accounts and zero level of confidence that the accounts are materially misstated. Tests of details are assumed to provide even stronger positive support, 0.85, for this assertion. In the baseline case, it is assumed all the collected

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<sup>1</sup> In general, an item of evidence in an evidential network would indirectly affect other variables (assertions) in the network through the interrelationship among the variables.

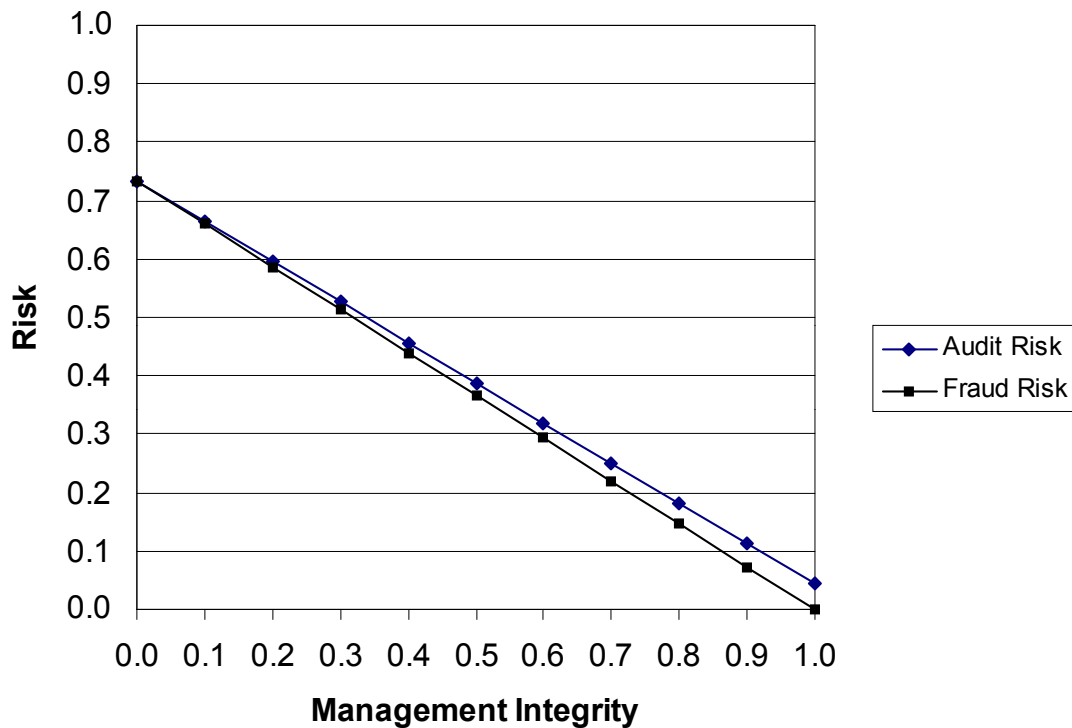
evidence supports the two sub-assertions and that auditors wish to reduce overall audit risk to a level no greater than 0.05.

**Table 1**  
**Belief Values for Baseline Model**

| Sources of Evidence  | Belief Values for No Misstatements |         | Belief Values for No Financial Statement Fraud or Misappropriations of Assets |         |
|--|------------------------------------|---------|---|---------|
|  | For                                | Against | For   | Against |
| Evaluation of Inherent Factors, Control Environment, and Understanding of Controls | 0.2                                | 0.0     | 0.05  | 0.0     |
| Tests of Controls  | 0.5                                | 0.0     | 0.05  | 0.0     |
| Analytical Procedures  | 0.2                                | 0.0     | 0.05  | 0.0     |
| Tests of Details   | 0.85                               | 0.0     | 0.05  | 0.0     |
| Final Analytical Procedures  | 0.1                                | 0.0     | 0.05  | 0.0     |
| Management Integrity   | Vary from 0.0 to 1.0               |         |   |         |

As shown in Figure 2, for this combination of belief values and a belief value for Management Integrity of 1.0, the model calculates support of 0.957 for the assertion ‘Financial Statements are Presented Fairly’, resulting in an audit risk of 0.043. This model and the assumed belief values represent a traditional, pre-SAS No. 82 approach to auditing and thus a benchmark with which to compare other situations.

**Figure 2**  
**Audit Risk and Fraud Risk for Baseline Model**



**THE EFFECT OF MANAGEMENT INTEGRITY ON AUDIT RISK**

Even though a formal assessment of fraud risk was not required prior to SAS No. 82, it does not follow that fraud risk did not exist. An analysis of the model in Figure 1 shows that for the audit risk actually to be approximately 0.05, the auditor must have an almost absolute level of confidence in the integrity of client management. As noted by Montgomery et al. (2002), “Most auditors assess their client’s honesty and integrity through rigorous client acceptance and continuance procedures, which might lead them to assume without question their clients are honest.”

The relationship between management integrity and risk for the baseline model is plotted in Figure 2 where audit and fraud risk are plotted against various levels of

confidence that management has integrity. As shown in Figure 2, only when management integrity is assigned a very high level of positive belief of 0.99 or greater does audit risk remain at or below 0.05. This supports the Montgomery et al. (2002) statement.

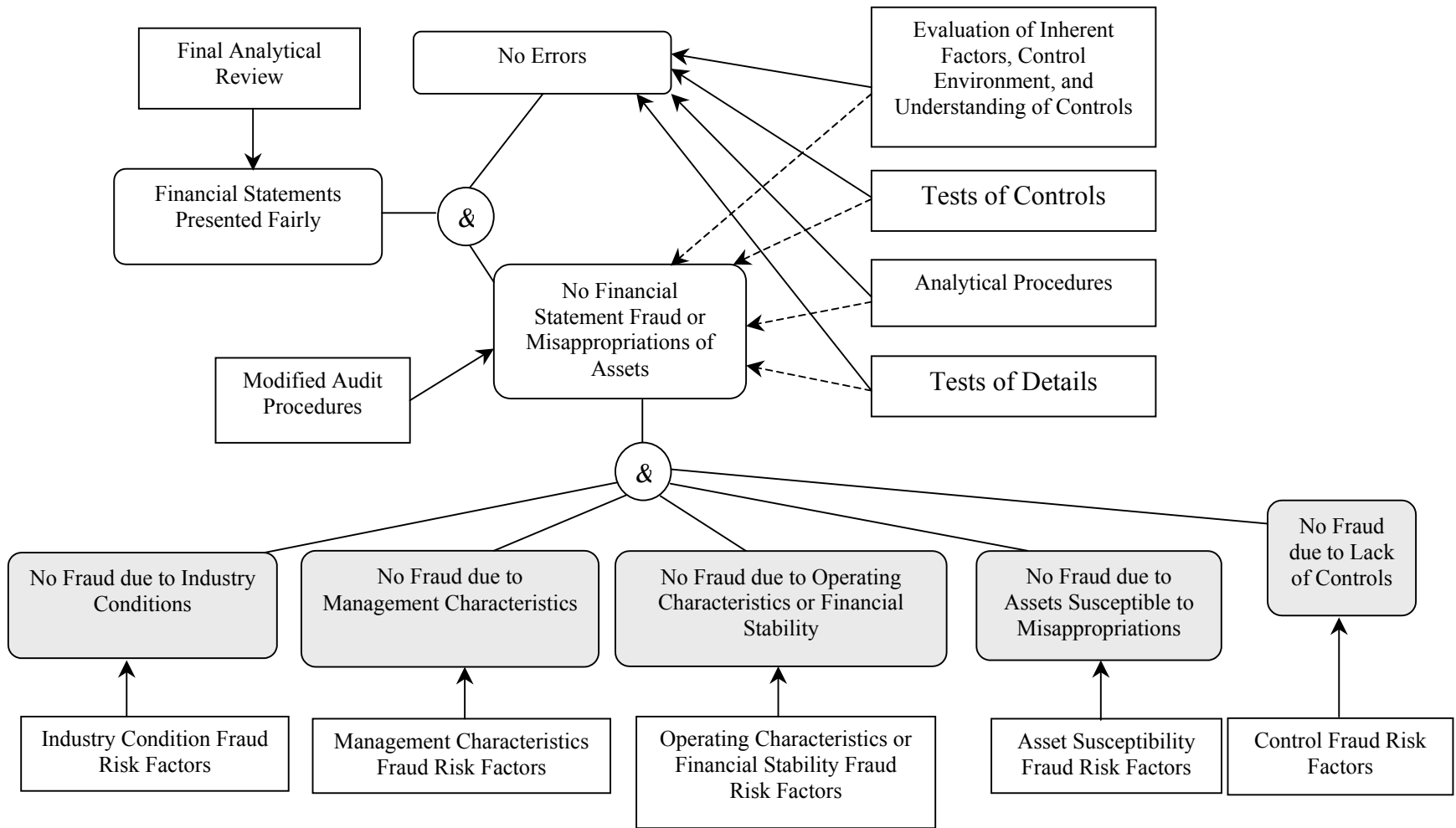
As it is unlikely that any management group can be considered to have zero likelihood of committing fraud, it seems apparent that including assertions and evidence that explicitly relate to fraud will provide a better assessment and control of overall audit risk. The issuance of SAS No. 82 was the initial attempt to create these relationships.

### **SAS No. 82 Model**

In Figure 3, the baseline model has been revised to incorporate the requirements of SAS No. 82. SAS No. 82 requires that, in addition to traditional audit procedures, the auditor explicitly must consider both the risk of fraudulent financial statements and the risk of misappropriation of assets. In the SAS, three categories of financial statement fraud and two categories of the risk of misappropriation of assets are provided, but the categories are not interrelated and are discussed as independently impacting the risk of fraud. As shown in Figure 3, these fraud categories are related to the main assertion “No Financial Statement Fraud or Misappropriations of Assets” through an ‘AND’ relationship, implying that there is no financial statement fraud or misappropriation only when there is no financial fraud introduced by any of these categories.

While the issuance of SAS No. 82 increased the auditor’s awareness of the risk of fraud (Mock and Turner 2002), no guidance was provided as to how to weight individual fraud risk factors, what an appropriate response should be when risk factors are identified, or how audit risk is affected by the existence of fraud risk factors. To examine the impact of SAS No. 82 on audit risk, Turner et al. (2002) provide one model of the

**Figure 3**  
**Baseline Model with Fraud Risk Assessment per SAS No. 82**



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NOTE: Solid lines with arrowheads connect stronger evidence to assertions. Dashed lines with arrowheads connect weaker evidence to assertions.

ARM with the addition of the newly required fraud risk assessment process. In examining actual cases from the Mock and Turner (2002) archival study; the model revealed that in the presence of risk factors, audit risk was increased substantially unless appropriate forensic audit procedures were performed. The model also revealed that the impact of management integrity or the lack thereof, is the major factor in reducing the risk of fraud, even in an environment of high incentives and opportunities.

### **The Fraud Triangle**

The ED released for public comment in February 2002 introduces three categories of factors that may be interrelated: Pressures and Incentives, Opportunities, and Attitudes and Rationalizations. These three categories are referred to by Montgomery et al. (2002) as the “Fraud Triangle.”<sup>2</sup>

The Fraud Triangle implies, but does not formalize, interrelationships between the three categories. Figure 4 shows the ARM with the addition of the components of the Fraud Triangle detailed in the ED. In this model, however, the three categories are not shown as being the three points of the triangle, but are connected by two relationships—one between Management Integrity and No Incentives, designated as R1, and a second between Management Integrity and No Opportunities, designated as R2.<sup>3</sup>

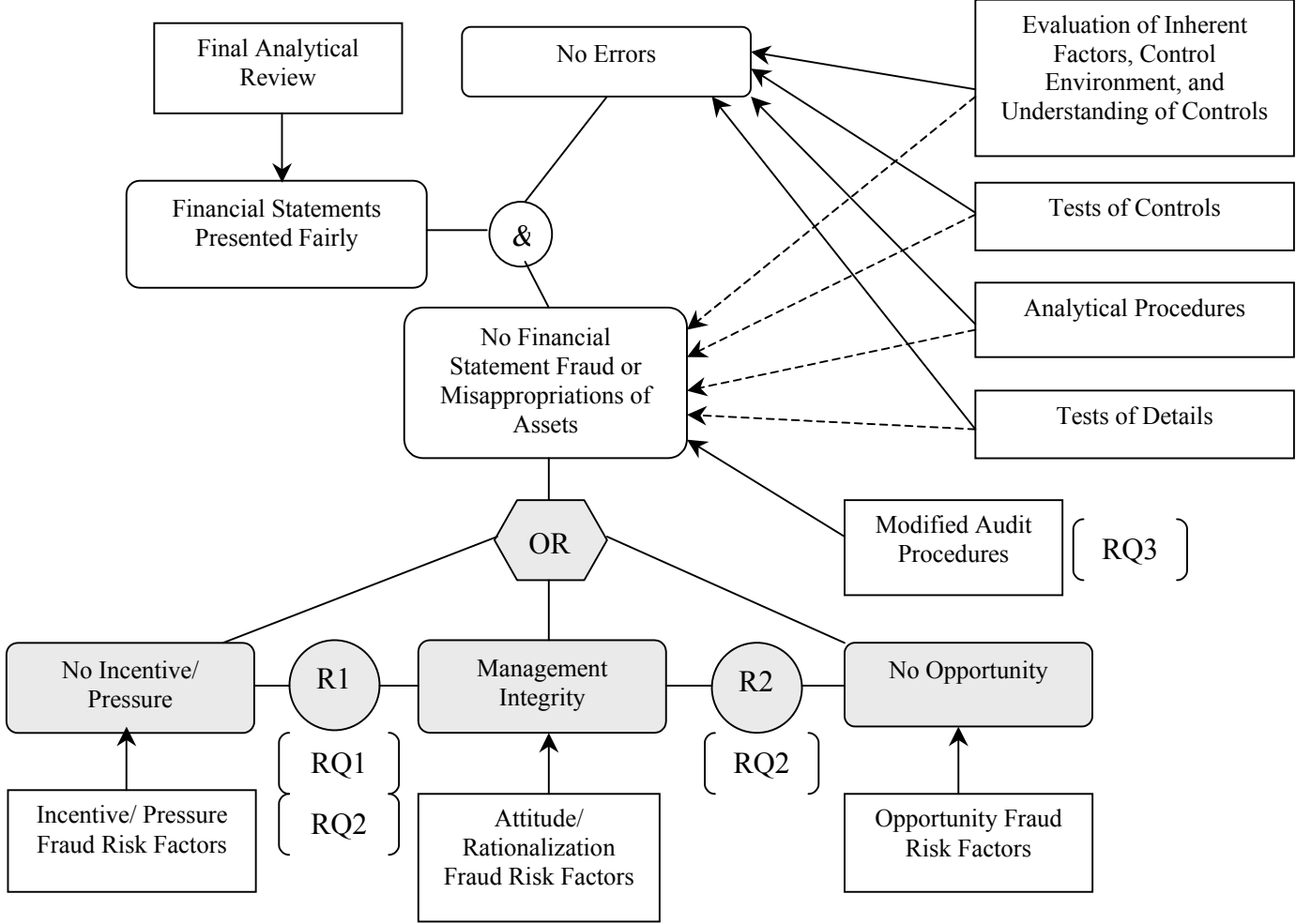
The R1 relationship creates a possible two-way interaction between Integrity and Incentives. This relationship recognizes that at lower levels of incentives, a manager may

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<sup>2</sup> This designation initially appeared in Occupational Fraud and Abuse (Wells 1997).

<sup>3</sup> For brevity, ‘Attitude/Rationalization’ subsequently will be referred to as Integrity and ‘Incentives/Pressures’ will be referred to as Incentives.

**Figure 4**  
**Baseline Model with Fraud Risk Assessment per Exposure Draft**



NOTE: Solid lines with arrowheads connect stronger evidence to assertions. Dashed lines with arrowheads connect weaker evidence to assertions.

exhibit very high integrity and not only may fail to respond to such incentives, but may work to reduce them. At higher levels of incentives, however, that same manager may decide that the incentives may be so compelling that the manager’s integrity is compromised and the rewards offered are sought actively (remindful of the cliché, “Every man has his price”). The relationship also recognizes that a manager with a lower level of integrity may seek to create or increase existing Incentives.

In the model, the assessment of the R1 interaction is made as follows. First, the auditor performing the assessment obtains information (evidence) related to fraud risk factors for the two left rectangles at the bottom of Figure 4. For example, given evidence related to management’s attitude or propensity toward rationalization, the auditor either may increase or decrease the belief in the assertion that the manager has Integrity. Evidence regarding the Integrity and Incentives assertions each may be assigned belief values both for and against the assertion, thus four possible combinations result from the relationship:

| <u>Assertion</u> | <u>Evidence About</u> |                             | <u>Impact on R1-Related Assertion</u> |
|------------------|-----------------------|-----------------------------|---------------------------------------|
|                  | <u>Assertion</u>      | <u>R1-Related Assertion</u> |                                       |
| Integrity        | For                   | No Incentives               | For (increase disincentives)          |
| Integrity        | Against               | No Incentives               | Against (increase incentives)         |
| No Incentives    | For                   | Integrity                   | For (integrity)                       |
| No Incentives    | Against               | Integrity                   | Against (i.e. lack of integrity)      |

Thus R1 is modeled such that high belief values for Integrity reduce the impact of Incentives on fraud risk while high values against Integrity (i.e. high belief regarding a lack of Integrity) increases the impact of Incentives. Similarly, a belief that Incentives are low increases the belief for Integrity while a belief that Incentives are high increases the belief in a lack of Integrity.

Similarly, the R2 relationship creates a possible two-way interaction between Integrity and Opportunities. This relationship recognizes that at lower levels of Opportunities, a manager may exhibit very high integrity and not only may fail to respond to afforded Opportunities, but may work to reduce them. At higher levels of Opportunities, however, that same manager may decide that the Opportunities may be so compelling that the manager's integrity is compromised and fraud risk is increased. The relationship also recognizes that a manager with a lower level of integrity may seek to create or increase existing opportunities.

Similar to R1, Integrity and Opportunities each may be assigned belief values both for and against the assertion, four possible combinations result from the relationship:

| <u>Assertion</u> | <u>Evidence About Assertion</u> | <u>R2-Related Assertion</u> | <u>Impact on R2-Related Assertion</u> |
|------------------|---------------------------------|-----------------------------|---------------------------------------|
| Integrity        | For                             | No Opportunities            | For (reduce opportunities)            |
| Integrity        | Against                         | No Opportunities            | Against (increase opportunities)      |
| No Opportunities | For                             | Integrity                   | For (integrity)                       |
| No Opportunities | Against                         | Integrity                   | Against (i.e. lack of integrity)      |

Thus, high belief values for Integrity reduce the impact of Opportunities on fraud risk while high values against Integrity (i.e. high belief regarding a lack of Integrity) increases the impact of Opportunities. Similarly, a belief that Opportunities are low increases the belief for Integrity while a belief that Opportunities are high increases the belief in a lack of Integrity.

To complete formulation of the triangle, the three components Integrity, No Incentives and No Opportunities are connected through an 'OR' relationship. This relationship implies that the assertion of 'No Financial Statement Fraud or Misappropriations of Assets' will be appropriate if and only if either management has

Integrity or if there is No Incentive for fraud or if there is No Opportunity to commit fraud.

Since, as previously noted, it is unlikely that any management group can be considered to have zero likelihood of committing fraud, it seems apparent that including assertions and evidence that explicitly relate to fraud will provide a better assessment and control of overall audit risk. Within Figure 4, the three primary research questions addressed in this paper are shown in brackets. These research questions explicitly address the effects of the variables included in the fraud triangle on audit risk.

**RQ1: What is the effect on Audit Risk of an interaction between Incentives and Management Integrity?**

To examine the effect of the R1 relationship, all assumptions regarding the strength of evidence shown for the baseline model are used. As previously noted, these assumptions result in an overall audit risk of 0.043. Additionally, the values shown in Table 2 are added to reflect inclusion of the Fraud Triangle assertions.

**Table 2  
Belief Values for Research Question 1**

| Sources of Evidence and Relationships       | Belief Values        |         |
|---|----------------------|---------|
|   | For                  | Against |
| Fraud Risk Factors for No Incentives        | 0.0                  | 1.0     |
| R1  | 0.2, 0.4, 0.6        | —       |
| Fraud Risk Factors for Management Integrity | Vary from 0.0 to 0.8 | 0.2     |
| R2  | 0.0                  | —       |
| Fraud Risk Factors for No Opportunities     | 0.0                  | 1.0     |
| Modified Audit Procedures (MAP)             | 0.0                  | 0.0     |

Included in Table 2 are the assumptions that there is a strong belief that both Incentives and Opportunities exist and a moderate belief in a lack of integrity on the part of management. This is shown by the very strong belief of 1.0 against both No Incentives and No Opportunities and the moderate belief of 0.2 against Integrity.<sup>4</sup> Also, it is assumed that the auditor has not performed any modified audit procedures (MAP) specifically designed to be forensic procedures directed at fraud.<sup>5</sup> This is designated as Case 1, where the auditors have identified possible “red flags” indicating that the risk of fraud may be non-zero, but the auditors conclude that existing controls and audit procedures adequately respond to such risk.<sup>6</sup> This case is shown in Figure 5.

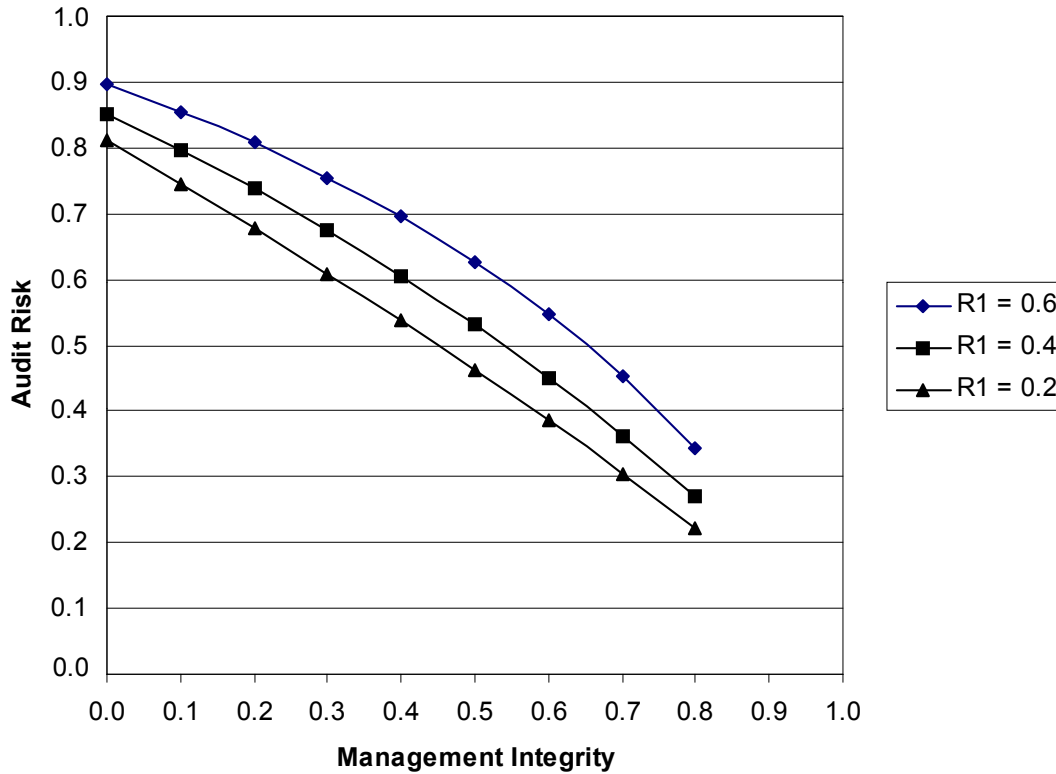
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<sup>4</sup> Note that assigning a belief value of 0.2 against Integrity restricts the maximum belief value for Integrity to 0.8.

<sup>5</sup> While SAS No. 82 requires an assessment of fraud risk during the planning process, no specific response to the risk assessment is required. Instead, the auditor may use professional judgment in determining how to respond appropriately. As detailed in Mock and Turner (2001, 2002), even though fraud risk factors are identified in many post SAS No. 82 audits, in 75 percent of the audits examined, no specific change in the audit program or in the staff assigned to the audit results.

<sup>6</sup> All cases used as examples in this paper are actual scenarios identified during an archival study of the impact of SAS No. 82 on the audit program (Mock and Turner 2001, 2002).

**Figure 5**  
**RQ1: What is the effect on Audit Risk of an interaction between Incentives and Management Integrity?**



As can be seen in Figure 5, the absence of any MAP in the presence of red flags substantially increases audit risk. Whereas the baseline model results in an audit risk of 0.043, the explicit consideration of the Fraud Triangle variables and the assumed values at  $R1 = 0.2$  increases the minimum achievable audit risk to 0.22. Increasing the interaction between Integrity and Incentives to  $R1 = 0.4$  and  $R1 = 0.6$  further increases the minimum achievable audit risk to 0.27 and 0.34, respectively.

**RQ2: What is the effect on Audit Risk of interactions between Incentives and Management Integrity and Opportunities and Management Integrity?**

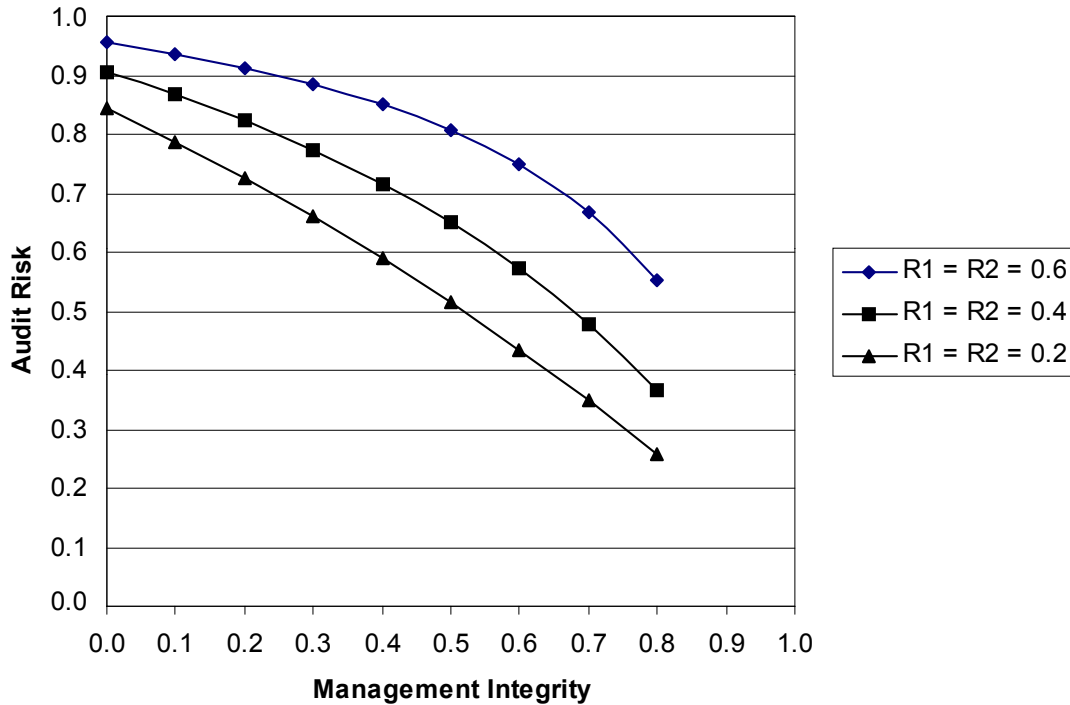
As relationships R1 and R2 may exist concurrently, RQ2 examines the impact of belief values regarding Management Integrity, Incentives and Opportunities in such conditions. Although R1 and R2 likely are independent in regard to values, the simplifying assumption is made that the two relationships will have equal values. The remaining assumptions, as shown in Table 3, are identical to those for RQ1.

**Table 3**  
**Belief Values for Research Question 2**

| Sources of Evidence and Relationships       | Belief Values        |         |
|---|----------------------|---------|
|   | For                  | Against |
| Fraud Risk Factors for No Incentives        | 0.0                  | 1.0     |
| R1  | 0.2, 0.4, 0.6        | —       |
| Fraud Risk Factors for Management Integrity | Vary from 0.0 to 0.8 | 0.2     |
| R2  | 0.2, 0.4, 0.6        | —       |
| Fraud Risk Factors for No Opportunities     | 0.0                  | 1.0     |
| Modified Audit Procedures (MAP)             | 0.0                  | 0.0     |

As shown in Figure 6, the addition of belief values for the R2 relationship increases the minimum achievable audit risk only moderately from 0.22 to 0.26 for  $R1 = R2 = 0.2$ . At higher levels of R1 and R2, however, much more substantial increases in audit risk result. For  $R1 = R2 = 0.4$ , audit risk increases from 0.27 to 0.37, a 37 percent increase. For  $R1 = R2 = 0.6$ , the increase in audit risk is from 0.34 to 0.55, a 62 percent increase. As the figure indicates, these risks are even higher for assumed values of management integrity that are less than the 0.8 maximum.

**Figure 6**  
**RQ2: What is the effect on Audit Risk of interactions between Incentives and Management Integrity and Opportunities and Management Integrity?**



**RQ3: What is the effect on Audit Risk of Modified Audit Procedures?**

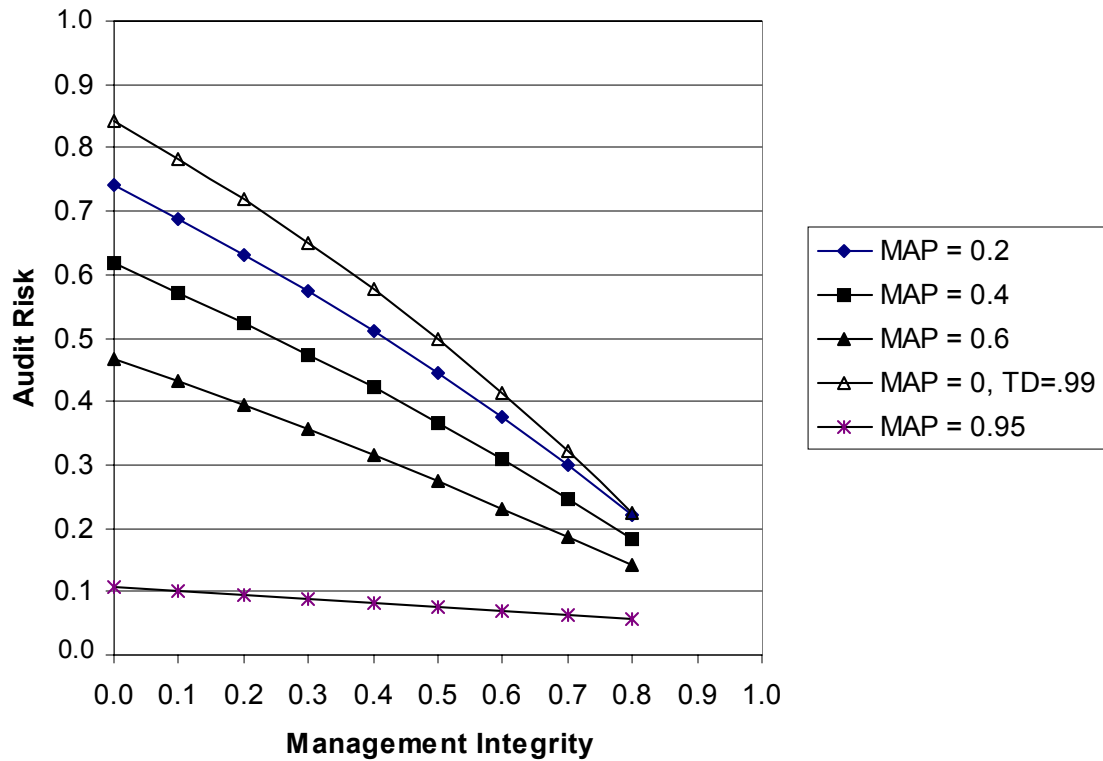
As demonstrated by RQ1 and RQ2, the existence of fraud risk factors without the performance of specific related forensic procedures (MAP) very likely will result in unacceptably high levels of audit risk. Accordingly, RQ3 examines the impact of such forensic procedures in reducing audit risk. As shown in Table 4, belief value assumptions are identical to those of RQ1 except belief values for MAP are examined at belief levels of 0.2, 0.4 and 0.6. This represents Case 2, where the auditors have identified possible “red flags” indicating that the risk of fraud may be non-zero and perform forensic audit procedures specifically selected to respond to such risk.

**Table 4**  
**Belief Values for Research Question 3**

| Sources of Evidence and Relationships       | Belief Values        |         |
|---|----------------------|---------|
|   | For                  | Against |
| Fraud Risk Factors for No Incentives        | 0.0                  | 1.0     |
| R1  | 0.2                  | —       |
| Fraud Risk Factors for Management Integrity | Vary from 0.0 to 0.8 | 0.2     |
| R2  | 0.2                  | —       |
| Fraud Risk Factors for No Opportunities     | 0.0                  | 1.0     |
| Modified Audit Procedures (MAP)             | 0.2, 0.4, 0.6        | 0.0     |

Figure 7 indicates that performing MAP can substantially reduce audit risk. For example, if belief values for MAP can be achieved at a 0.6 level, audit risk can be

**Figure 7**  
**RQ3: What is the effect on Audit Risk of Modified Audit Procedures?**



reduced from the minimum of 0.24 achieved in RQ1, down to an audit risk of 0.14, a 42 percent decrease.

Although there has been a substantial decrease in audit risk, the assumed desired value of 0.05 was not achieved with a strength of evidence provided by MAP of 0.2, 0.4 or 0.6. Further analysis indicates that only with a much more substantial belief value for MAP of 0.95 can audit risk be reduced to traditionally acceptable levels. This is shown as the lower graph in Figure 7.

Also shown as the top graph in Figure 7 is Case 3. In this case, the auditor identifies fraud risk factors, but instead of performing specific MAP directed at detecting fraudulent activities, the auditor simply increases the extent of traditional audit procedures. Such a misidentification of appropriate MAP likely leads to an achieved audit risk much greater than the assumed desired audit risk of 0.05 or less. In Case 3, achieved audit risk is 0.23, over 450 percent higher than the assumed desired audit risk of 0.05. Clearly, such misinterpretations may result in audit failures as insufficient evidence is evaluated in regards to financial statement fraud or misappropriations of assets.

## **SUMMARY**

In this paper we analyze the effects on audit risk of the factors in the “Fraud Triangle” discussed in the Exposure Draft (ED) recently published by the AICPA. The elements of the fraud triangle have been discussed in a recent article by Montgomery et al. (2002). In particular, we analyze the effect on Audit Risk of (1) an interaction between Incentives and Management Integrity, (2) an interaction between Incentives and Management Integrity, and between Opportunities and Management Integrity, and (3) Modified Audit Procedures.

To analyze the effects, this paper develops a series of models of the audit process augmented by the addition of components of the fraud triangle. The initial model represents a baseline, Pre-SAS No. 82, audit where fraud risk is not explicitly modeled whereas the complete model encompasses both SAS No. 82 requirements and the recent ED intended to modify SAS No. 82. The models are used to examine three research questions focusing on the interrelationships of the components of the fraud triangle. These models extend prior work (e.g. Srivastava and Shafer 1992, Dutta et al. 1998, Turner et al. 2002) by adding explicit assertions and evidential nodes related to fraud risk assessments and by examining interrelationships among factors that may affect fraud risk.

To begin the analysis, we first examine a typical pre-SAS No. 82 audit by assuming that no specific fraud risk assessment is performed. Using this as a baseline model, we then add the components of the fraud triangle, including relationships between Management Integrity and Incentives, and between Management Integrity and Opportunities.

In RQ1, we examine the effect of an interrelationship, designated R1, between Integrity and Incentives.<sup>7</sup> This relationship assumes that at lower levels of incentives, a manager may exhibit very high integrity and not only may fail to respond to such incentives, but may work to reduce them. At higher levels of incentives, however, that

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<sup>7</sup> In prior research (Turner et al. 2002), it is shown that fraud risk will be negligible if management is assumed to have high integrity. In this paper, we relax this assumption and consider cases where the auditor has at least moderate doubt about management integrity.

same manager may decide that the incentives may be so compelling that the manager's integrity is compromised and the potential rewards are sought actively. The relationship also recognizes that a manager with a lower level of integrity may seek to create or increase existing incentives.

While management integrity is important in controlling audit risk to a low level as evidenced from Figure 2, in the presence of an interaction (R1) between incentive and management integrity, audit risk increases as the interaction increases. In fact, if there is doubt about management integrity, then audit risk cannot be reduced to traditionally acceptable levels unless appropriate modified audit procedures are performed as evidenced in Figure 5. The impact is even more severe at higher levels of the interaction.

In RQ2, we add the Integrity/Opportunity interrelationship (R2) to our framework. The R2 relationship creates a possible two-way interaction between Integrity and Opportunities. For example, this relationship recognizes that at higher levels of opportunities, a manager may decide that the opportunities may be so compelling that the manager's integrity is compromised and fraud risk is increased. The relationship also recognizes that a manager with a lower level of integrity may seek to create or increase existing opportunities.

The analyses show that when both types of interactions are present, then audit risk increases further. As seen from Figure 6, this result makes it even more difficult for the auditor to reduce the audit risk to an acceptable level without performing appropriate modified audit procedures. The effect is even more pronounced at higher values of R1 and R2. These results demonstrate that even if there is little doubt about the management's integrity, if we assume that management integrity could be compromised

given the right incentive and opportunity, then the risk of fraud increases significantly. Without performing appropriate modified audit procedures, audit risk can never be reduced to traditionally acceptable levels.

In RQ3, we examine how effective modified audit procedures must be to reduce audit risk to traditionally acceptable levels when audit evidence implies fraud risk factors for Incentives and Opportunities both are present. Figure 7 presents the impact of modified audit procedures on audit risk under the assumption that both types of interactions, R1 and R2, are present at a low level (0.2). It is clear that as there is increased evidence from modified audit procedures that there is no fraud, audit risk decreases. Also, audit risk decreases as the evidence for management integrity increases. However, without performing appropriate modified audit procedures and obtaining evidence supporting no fraud, audit risk will never be reduced to traditionally acceptable levels.

This situation is similar to one observed in a prior archival study (Mock and Turner 2002). In one of the actual audit cases studied, the auditor identified the risk of fraud, but modified audit procedures by increasing test of details. Although this approach provided a high level (0.99) of support for the assertion that there was no material misstatement due to errors, such tests likely provided little support for the assertion that there was No Fraud. In such a case, if R1 and R2 relationships were present, the audit risk likely would be unacceptably high.

Thus, assuming that the R1 and R2 relationships are present, our analyses indicate that modified audit procedures must provide a very high strength of evidence (i.e. 0.95) before audit risk is reduced to a traditionally acceptable level. Given that forensic

procedures are early in their development, obtaining audit evidence with such “power” may be a challenging task indeed!

In conclusion, our models and related analyses provide a method of incorporating objectively the factors in the fraud triangle and to assess their impact on audit risk. This type of assessment should help an audit team plan and appropriately modify audit procedures to control audit risk to an acceptable level. The results of these analyses support the concept of the fraud triangle in that the relationships between the three components are shown to have a substantial impact on audit risk. The findings also support the recommendation by the Panel on Audit Effectiveness that a “forensic-type fieldwork phase” be introduced into audits (PAE 2000, 88). As noted by the Panel, “During this phase, auditors should modify the otherwise neutral concept of professional skepticism and presume the possibility of dishonesty at various levels of management, including collusion, override of internal controls and falsification of documents.” Results indicate that the evaluation of management integrity is a critical part of developing an opinion as to the fairness of presentation of financial statements.

Although there are significant limitations in modeling efforts such as that described here, this paper represents an initial formal modeling of the nature of financial statement audits where explicit fraud risk assessments are required. As shown in this and the prior study, management integrity is a critical factor in assessing fraud risk, as is the potential use of appropriate modified (forensic) audit procedures in cases where management integrity is even somewhat questioned and where fraud risk factors are identified.

Future research is needed to further examine how the new requirements of the ED (AICPA 2002) affect any formal framework of audit risk that incorporates fraud risk, how to better specify variable interactions such as those between integrity, incentives and opportunities, and how to obtain valid, field-based assessments of the values that are needed to instantiate the model and to calculate fraud and audit risk.

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