ABSTRACT

Title of Dissertation: INTERNAL CONTROL, ENTERPRISE RISK
MANAGEMENT, AND FIRM PERFORMANCE

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This dissertation investigates two research questions arising from the regulation of internal controls required by Sarbanes-Oxley Act of 2002 (SOX). The first research question asks whether better internal controls can enhance firm performance? To address this question, the relation between market-value and internal control is estimated by a residual income model. Firms with weak internal controls are identified as those that disclose material weaknesses in internal controls in periodic filings from August 2002 to March 2006, as required by SOX. The empirical results, based on a sample of 708 firm-years with the disclosures of material weaknesses, show that firms with weak internal controls have lower market-value.

Building on the' efforts for SOX to improve internal controls, more and more firms are starting to adopt Enterprise Risk Management (ERM), because sound internal control system rests on adequate and comprehensive analysis of enterprise-wide risks. In light of this trend triggered by SOX, the second research question in this dissertation asks whether implementation of ERM has an impact on firm performance? The basic approach to answer this question uses a contingency perspective, since all risks arise from the

firm's internal and external environment. More specifically, the basic argument states that the relation between ERM and firm performance is contingent on the proper match between ERM and five key contingency variables: environment uncertainty, industry competition, firm size, firm complexity, and monitoring by the firm's board of directors. A sample of 114 firms disclosing the implementation of ERM in their 2005 10Ks and 10Qs are identified by keyword search in EDGAR database. In developing the proper match, high performing firms are defined as those with greater than 2% one-year excess return to develop the proposed proper match. An ERM index (ERMI) is constructed based on the Committee of Sponsoring Organizations (COSO) ERM's (2004) definition of four objectives: strategy, operation, reporting, and compliance. The contingency view is supported by the empirical evidence, since the deviation from the proposed proper match is found negatively related to firm performance.

INTERNAL CONTROL, ENTERPRISE RISK MANAGEMENT,

AND FIRM PERFORMANCE

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Dedication

Dedicated to my dearest Mom and Dad.

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Chapter 1 Introduction

1.1 Motivation

The introduction of the Sarbanes-Oxley Act of 2002 (SOX), as a response to

well-publicized accounting scandals, requires all public companies to disclose internal

controls over financial reporting. Specifically, Section 404 of SOX requires management

of public companies to issue an internal control report in which they take responsibility

for maintaining adequate internal control, and make assertions concerning their

effectiveness. The company's auditor must then issue a separate opinion on

management's assertions and the adequacy of the internal controls. Moreover, Section

302 of SOX requires Chief Executive Officers (CEOs) and Chief Financial Officers

(CFOs) to certify in the company's quarterly and annual reports that they have reviewed

the report, that the internal control report contains no misrepresentations, that the

financial information is fairly presented, that they have reported any internal control

weaknesses (including fraud) to the audit committee, and, that they have reported any

material changes in internal controls.

SOX's regulation on internal control brings about at least two fundamental

research questions, as described below. First, the disclosures of material weaknesses in

internal controls as required by SOX provide the stock market with the information to

identify firms having poor internal controls such as deficient revenue-recognition policies,

lack of segregation of duties, deficiencies in the period-end reporting, and inappropriate

account reconciliation (Ge and McVay, 2005). Therefore, by examining the impact of

disclosures of weak internal controls on firm value, we are able to answer the first

fundamental question about the relation between internal controls and firm performance.

Second, some companies have already moved beyond the compliance with SOX

to engage in Enterprise Risk Management (ERM) (PWC, 2004). One reason for the rise

in ERM is another regulatory change brought by New York Stock Exchange (NYSE)

Corporate Governance Rules that explicitly require registrant audit committees to assume

specific responsibilities with respect to "risk assessment and risk management," including

risks beyond financial reporting (NYSE, 2003). Lin and Wu (2006) and Shenkir and

Walker (2006) explain that a sound internal control system rests on adequate and

comprehensive analysis of enterprise-wide risks, and, in order to effectively comply with

Section 404 of SOX, firms are advised to establish ERM. That is also the reason that

COSO ERM (2004) expanded on COSO (1992) Internal Control Framework to provide a

more robust and extensive focus on the broader subject of ERM.[1] Besides the

compliance with SOX, the implementation of ERM has already been documented to

improve firm performance (e.g., see Hoyt et al.,2006; and Nocco and Stulz, 2006).

However, one of the successful factors for implementing ERM is to consider broadly the

overall risks arising from business environment (Bowling and Rieger, 2005). The second

fundamental question in this dissertation, therefore, asks whether the relation between

ERM and firm performance is contingent upon the firm's contextual factors? Some firms

already voluntarily disclose their implementation of ERM in their annual or quarterly

filings to the Securities and Exchange Commission (SEC) and this provides us with

empirical data to address the second research question about the contingency perspective

on the relation between ERM and firm performance.

1.2 Outline of the Dissertation

In this dissertation I address the aforementioned research questions regarding the

impact of internal controls and ERM on firm performance with two separate studies.

These studies are presented in Chapter 2 and Chapter 3 respectively.

Chapter 2, entitled "Internal Control and Firm performance," investigates the

research question about the impact of internal controls on firm performance. I examine

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[1] The acronym COSO stands for the Committee of Sponsoring Organizations of the Treadway Commission and is also known as the Treadway Commission.

the market valuation of a firm's disclosures of material weaknesses in internal control using a sample of 708 disclosures of material weaknesses from August 2002 to March 2006. Based on a modified Ohlson (1992) residual-income valuation model, firms disclosing material weaknesses in internal controls tend to have lower market-value. This relation is robust to the correction for potential self-selection bias using a two-stage approach with the inverse Mills ratio and a propensity score match. Next I classify disclosures of material weaknesses into reporting-only, versus more-than-reporting material weaknesses. More-than-reporting material weaknesses are more negatively related to market-value than reporting-only material weaknesses.

Chapter 3, entitled "Enterprise Risk Management and Firm Performance," investigates the research question about the contingency view of ERM and firm performance. The basic argument in this chapter is that the relation between ERM and firm performance is contingent upon the appropriate match between ERM and the following five factors affecting a firm: environmental uncertainty, industry competition, firm size, firm complexity, and monitoring by the firm's board of directors. A sample of 114 firms disclosing the implementation of their ERM activities in their 10Ks and 10Qs filed with the U.S SEC for 2005 is identified by a keyword search of the SEC EDGAR database. High performing firms, defined as firms with 2% one year excess return ended

end of 2005, are used for developing the proposed proper match between ERM and five contingency variables. The measure for firm performance is then regressed on the absolute value of deviation from the proposed proper match to check whether more deviation from the proper match will be negatively related to firm performance. This negative relation is found and the above basic argument in response to the second research question is therefore empirically confirmed. This finding is robust to the correction for self-selection bias, choosing different cutoffs for high performing firms, an alternative measure for board monitoring, and alternative timing for firm performance.

Chapter 4, the last chapter of this dissertation, provides a brief summary of the findings from the two studies included in this dissertation.

Chapter 2 Internal Control and Firm Performance

2.1 Introduction

The large number of accounting scandals during the early part of the 21 century

resulted in the Sarbanes-Oxley Act of 2002. Sections 302 and 404 of this Act require

companies to maintain, assess, and disclose internal control over financial reporting. The

disclosures of internal controls were intended to provide financial statement users with an

early warning about potential future problems that could result from deficiencies in

internal controls (PCAOB, 2004).

The main focus of this chapter is to examine the market valuation of internal

control of the firm. Internal controls are important for an organization, since a weakness

in internal control might result in: 1) higher informational risks for stockholders which

increase the firm's cost of capital, 2) higher intentional or unintentional bias in reported

earnings, and 3) inefficient and ineffective business operations which might harm the

firm's ability to persistently earn profits. Thus, weak internal controls have the potential

to impair the firm value.

While the impairment of market-value has been suggested in prior literature

(Kinney, 2000), the unavailability of internal control data for firms, in general, has

precluded an empirical investigation. Thus, effect of internal control on firm's market-value remains an open question in the value relevance literature. To study the effect of internal control, weak internal controls are identified as the disclosures of material weaknesses in internal controls in firms' annual reports now required by Section 404 of SOX. By definition, when there is a material weakness in internal control, there is "*more than a remote likelihood that a material misstatement of the annual or interim financial statement will not be prevented or detected*" (PCAOB, 2004, page 155).

To investigate whether internal control has impact on market valuation, this study utilizes a residual-income model, which is an established methodology in accounting literature (see, e.g., Feltham and Ohlson, 1995; Ohlson, 1995; Hand, 2001; and Ohlson, 2001). The residual-income model is frequently employed to measure the relation between market-value and reported accounting information in value relevance studies (Barth et al, 2001). In this model, the firm's market-value equals book value of equity plus present value of expected future abnormal earnings. It is hypothesized that weaknesses in internal control will decrease the present value of expected abnormal earnings. The decrease could be due to the combination of the increase in the cost of capital, the increase in the variance of measurement bias in reported earnings, and the

decrease in the future actual earnings. This in turn reduces the firm's market-value. Thus,

the question of interest is if internal controls will have negative impact on firm value?

The main finding from this investigation is that material weaknesses in internal

controls are associated with lower market-value, using a sample of 708 disclosures of

material weaknesses in annual reports from August 2002 to March 2006. This relation is

robust using a subset of material weaknesses disclosed only in 10Ks (i.e., not in 10K

amendments, 10KSB, or 10KSB amendments).[2]

Since firms can choose their internal controls and their efforts to discover and

disclose any known deficiencies, there is a concern about self selection bias in this study

(Ashbaugh et al., 2006). The concern about firms' choices of disclosures can be

prevented by the fact that the disclosures of material weaknesses are mandatory under

SOX.[3] Therefore, using the sample identified from the disclosures of material weaknesses,

the main empirical finding already precludes firms' choices to disclose and shows the

hypothesized relation between internal control and firm value. However, using

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[2] 10K is the firm's annual report. 10KSB is the annual reports filed by small sized firms under 75 millions of market capitalization.

[3] According to PCAOB (2004), material weakness is the most severe control deficiencies. A material weakness is "a significant deficiency, or combination f significant deficiencies, that results in more than a remote likelihood that a material misstatement of the annual or interim financial statement will not be prevented or detected." A Significant deficiency is defined as "a control deficiency, or combination of control deficiencies, that adversely affects the company's ability to initialize, authorize, record, process, or report external financial data reliably in accordance with generally accepted accounting principles such that there is more that a remote likelihood that a misstatement of the company's annual or interim financial statements that is more than inconsequential will not be prevented or detected." Only material weaknesses are required to be publicly disclosed under Section 302 and 404; therefore, this study does not examine less severe significant deficiencies.

disclosures of material weaknesses only addresses firms' choices of disclosing those detected material weaknesses, but not firms' choices of the efforts on maintaining and evaluating internal controls. This study, therefore, further addresses the potential self-selection bias by employing the following two methodologies: 1) the Heckman two-stage estimation procedure (Heckman, 1979) and 2) propensity score matching. The Heckman two-stage approach starts with estimating a probit model of whether or not a firm discloses material weaknesses. The estimation results from the probit model are used for the calculation of inverse Mill's ratio. The first method of controlling for self-selection bias is to include the above inverse Mill's ratio in the residual income model. The second technique to control for the self-selection issue is known as propensity score matching (LaLonde, 1986), which creates a matched sample based on firm's industry, year, and the predicted value from the probit model in the above Heckman two-stage estimation procedure. The predicted value from the probit model measures a firm's propensity for having material weaknesses in internal controls. The propensity score matching can be used for controlling the self-selection problem by matching two firms with the same propensity of having weak internal controls, while one discloses the weaknesses and the other does not. The empirical findings are robust to the control of self-selection bias using the inverse Mills ratio and the matched sample approaches.

The internal control in this study is focused on material weaknesses, the most

severe classification of internal control deficiency. However, within this classification

scheme, there is substantial variation in what constitutes a "material weakness." Although

SOX's requirement limits firm's accountability to internal controls over financial

reporting, Lin and Wu (2006) suggest that firms might disclose material weaknesses

above and beyond what is required by the SOX. Committee of Sponsoring Organizations

(known as COSO) and Institute of Chartered Accountants in England and Wales

published, respectively, the COSO (1992) and Turnbull (1999) internal control

frameworks that define the goal of internal controls as broader than the reliability of

financial reporting alone. In terms of the residual income model, weaknesses in financial

reporting-only internal controls (FRICs) might simply affect firm's cost of capital and

measurement errors in reported earnings, while weaknesses in more-than-reporting

internal controls (MTRICs) might also reduce the effectiveness and efficiency of business.

Second hypothesis in this study, thus, focuses on the fact that the weaknesses in MTRICs

are expected to be more negatively related to firm value than the weaknesses in FRICs.

This hypothesis is supported by empirical results.

To better understand the nature of the relation between internal control and

market-value, I conduct additional analysis as well. First, I classify material weaknesses

announcements as whether they are related to the five components in COSO (1992):

control environment, risk assessment, control activity, information and communication,

and monitoring. Subsequently, I analyze whether weaknesses related to control

environment have the greatest negative impact on firm value than weaknesses related to

any of the other four components. Second, repetitive occurrences of material weaknesses

imply ineffective remediation measures and an additional test is to find out whether these

repeat weaknesses are related to lower firm value. Third, I test whether market poses

negative concerns when material weaknesses are disclosed in the amendment of annual

reports, instead of in the annual reports. Finally, I explore whether market-value is more

favorable under voluntary or mandatory disclosures of material weaknesses.

The study reported in this chapter makes two contributions to the accounting

literature. First, it uses market-value to assess the value relevance of disclosures of

control deficiencies, complementing the literature that uses market responses to

announcements of material weaknesses (Beneish et al, 2006; De Franco et al, 2005; and

Hammersley et al, 2007). More importantly, to my knowledge, this is the first study to

use the residual income model (Ohlson, 1995) as the market valuation model for internal

controls. Conceptually, it makes sense that good internal controls can help market's

expectation for future abnormal earnings. Thus, the research findings reported in Chapter

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2 present empirical evidence to support the theoretical link between internal control and firm value.

Second, this research provides empirical evidence on the impact of Section 404 in SOX on firm-value. Section 404 has been among the most contentious sections of SOX, with many critics alleging that the compliance costs far exceed any benefits. The study in this chapter provides evidence of the impact of Section 404 in SOX by showing that disclosures of material weakness in internal controls are associated with lower firm value.

The remainder of Chapter 2 proceeds as follows: Section 2.2 is the literature review. The hypotheses are developed in Section 2.3, while, Section 2.4 describes the research design. Section 2.5 details the main empirical findings. In Section 2.6 results from additional tests are discussed. Section 2.7 concludes.

2.2 Literature on Deficiencies in Internal Controls

Research on internal controls is a relatively new but a rapidly growing area in the accounting literature. The majority of the studies involving internal controls are focused on investigating the characteristics of firms that disclose material weaknesses in internal control. For example, Ge and McVay (2005) found that companies with material weaknesses are more complex, smaller, and less profitable than firms that do not disclose material weaknesses. Doyle et al. (2007b) confirmed Ge and McVay's results and also

show that firms disclosing material weaknesses are younger, growing rapidly, or undergoing restructuring. Similarly, Ashbaugh et al. (2006) document that firms reporting internal control weaknesses have more complex operations, have experienced recent changes in organizational structure, are at increased exposure to accounting risks, and have fewer resources to invest in internal control. Furthermore, Doyle et al. (2005) indicated that firms with material weaknesses have a lower earnings quality than those that do not report material weaknesses.

Additionally, Hammersley et al. (2007) showed a negative market reaction to firms that had reported material weaknesses in internal control per the requirement of SOX Section 302. Using a sample of 102 firms that had reported internal control weaknesses without other material news spanning the event window, De Franco et al. (2005) investigated whether the market reaction to the internal control weaknesses varied by investor size. Their findings revealed a negative market reaction during the three-day window relative to the disclosure of material weaknesses. Beneish et al. (2006) investigated whether the effect of material weaknesses on the cost of capital and on stock prices is associated with audit quality. They found a negative return during a three-day window during which material weaknesses were disclosed and also discovered that, when audit quality was lower, the cost of capital and returns were more negative for firms with

material weaknesses. However, Ashbough-Skaife et al. (2006) and Bryan and Lilien (2005) did not find a negative market reaction to the disclosures of material weaknesses.

Instead of focusing on the market response as in the literature, this study investigates whether market-value is negatively associated with the disclosures of material weaknesses in internal control weaknesses. In other words, instead of using the "marginal information content approach" as adopted in the current literature related to the value relevance of control deficiencies, this study chooses "incremental association approach."[4] The key distinction between using market-value and market response in value-relevance studies is that the studies using market-value mainly concern about what is reflected in firm value, while studies using market response try to capture what is reflected in the changes in value over a specific period. Past studies on the value relevance of controls deficiencies use market response to emphasize the timing of the announced control-deficiency information reaching to the market (Beneish et al, 2006; De Franco et al, 2005; and Hammersley et al, 2007). In contrast to the existing literature, this research uses market-value because the focus of this study lies on how the

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[4] Holthausen and Watts (2001, Page 6) define "incremental association studies" as investigating whether the accounting number of interest is helpful in explaining value or return (over long windows) given other specified variables. "Marginal information content studies" are defined as investigating whether a particular accounting number adds to the information set available to investors.

disclosures of weak internal controls are reflected in the firm value, instead of the timing

of information being impounded by the market.

2.3 Hypotheses Development

Ohlson (1995) sets out a valuation model in which current market-value is related to

current accounting numbers via investors' use of these numbers to inform expectations of

future accounting data, as shown in the following equations.

$$MV_t = BV_t + \text{present value of expected future abnormal earnings} \qquad (2.1a)$$

$$= BV_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t[Y^a_{t+\tau}] \qquad (2.1b)$$

$$= BV + \sum_{\tau=1}^{\infty} R^{-\tau} E_t[Y_{t+\tau} - (R_t - 1)BV_{t+\tau-1}] \qquad (2.1c)$$

where MV_t is the firm's market-value at time t,

BV_t is the firm's book value at time t,

(R_t-1) is the firm's cost of capital,

Y^a_t is the abnormal earnings, defined as $Y^a_t = Y_t - (R_t - 1)BV_{t-1}$,

Y_t is the reported earning at time t, and

$E[\bullet]$ is the expectation operator.

A disclosure of a material weakness in internal control might reduce firm value

(MV_t) due to any one or a combination of the three reasons. First, weak internal control

might increase a firm's cost of capital (R_t-1). While Ohlson (1995) uses a risk free

discounting rate to exclude the impact of information uncertainty on a firm's cost of

capital, Easley and O'Hara (2004) have shown that increased information uncertainty can

result in an increase in a firm's cost of capital. Ashbaugh et al (2006) and Beneish et al

(2005) have shown that weaknesses in internal control are related to higher information uncertainty and thus higher firm's cost of equity capital. Higher cost of capital will increase the discount rate R_t, decrease the present value of the expected future abnormal earnings, and accordingly decrease the market-value MV_t.

Second, internal control deficiencies reduce a risk-averse stockholder's expected value of future earnings (i.e., $E_t[Y_{t+\tau}]$ in equation (2.1c)). In Ohlson's (1995) model, the information dynamic of the abnormal earnings assumes a stochastic process that future abnormal earnings will be the weighted average of the current abnormal earning and other information, plus a mean-zero error term (i.e., $\tilde{Y}_{t+1}^a = \omega Y_t^a + v_t + \tilde{\varepsilon}$, where ω is a known fixed weight of Y_t^a, v_t is the other information related to abnormal earnings, and $\tilde{\varepsilon}$ is the measurement error). Doyle et al (2007a) conclude that internal control appears to be an underlying, fundamental driver of accruals quality. Lower accrual quality may increase variation of the measurement errors in a financial reporting system. A weakness in internal control may have negative impact on accrual quality, which in turn increases the variance of measurement error ($\tilde{\varepsilon}$). Ashbaugh et al (2006) posits that weak internal controls can impair the quality or precision of accounting signals and affect market participants' assessment of the variance of a firm's cash flows and the covariance of the firm's cash flows with aggregate market cash flows. For a risk-neutral stockholder as

assumed in Ohlson (1995), the measurement error $\tilde{\varepsilon}$ has mean-zero and the precision of

accounting system has no impact on the expected future abnormal earnings (i.e.,

$E\left[\tilde{Y}_{t+1}^{a}\right]=\omega E\left[Y_{t}^{a}\right]+v_{t}$). However, for a risk-averse stockholder, a more realistic

assumption, it can be easily shown that the variance of the measurement error will reduce

the stockholder's expectation of future abnormal earning in equation (1.1b) and therefore

will lead to a lower market-value.[5]

Third, internal control deficiencies may reduce the effectiveness and efficiency of

business operation. Cushing (1974) mathematically shows that internal controls facilitate

effective operation by enhancing the reliability of the system, which increases the firm's

profit. Demski (1969) analyzes the informational role of controls in providing

management's operation decisions with feedforward and feedback information.[6]

Deficiencies in internal control reduce the effectiveness and efficiency of business

operations, which may lower stockholders' expectation of future earnings (i.e.,

$E_{t}\left[Y_{t+\tau}\right]$ in equation (2.1c)) and therefore lower market-value MV_{t} .

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[5] According to Markowitz (1952), a risk-averse investor is willing to pay risk premium to avoid a risky situation, for example, the variance of measurement error caused by weak internal control. Therefore, it is reasonable to state that a risk-averse might subtract a positive factor of risk premium from expected value of future abnormal earnings (i.e., $E\left[\tilde{Y}_{t+1}^{a}\right]=\omega E\left[Y_{t}^{a}\right]+v_{t}$ - *risk premium*).

[6] According to Demski (1969), feedforward information is to specify all facets, as well as to optimize, the model in order to predict the optimum control values for the next decision period; while feedback information is used for the dual processes of implementation adaptation and model change to accommodate significant system and environmental perturbations.

Based on the above analysis, weak internal controls might reduce a firm's market-value by increasing the firm's cost of capital, decreasing the precision of accounting information, and impairing the effectiveness and efficiency of business operations. As such, disclosures of internal control weaknesses might cause investors to reevaluate their assessment of the quality of management's oversight over the financial reporting process, leading to revisions in expectations about the firm's future profitability or to revisions in perceptions of firm risk (Hammerley et al., 2007). I, therefore, hypothesize the disclosure of material weaknesses of internal controls will be negatively associated with the firm value.

Hypothesis 1: The disclosures of material weaknesses of internal controls will be negatively associated with the firm value.

The broader objectives of internal controls are not limited to the reliability of financial reporting as required by SOX alone. A number of key internal control frameworks, such as COSO's Integrated Internal Control Framework (1992) and Turnbull's Guidance on Internal Control (1999), have been developed prior to the high-profile accounting scandals at the turn of the century. COSO (1992) defined internal control as follows:

"…a process, effected by an entity's board of directors, management and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories:

- *Effectiveness and efficiency of operations.*
- *Reliability of financial reporting.*
- *Compliance with applicable laws and regulations."*

Turnbull (1999), notwithstanding viewing internal control as a system, defines internal control the same as COSO (1992) to achieve three objectives in operations, reporting, and compliance.[7] COSO (1992) and Turnbull (1999) both took a broader approach to internal control than SOX, in terms of scope, objectives, and approach. They focused on all controls covering the company's entire range of activities and operations, not just those directly related to financial reporting, and adopted a risk-based approach to internal control (IFAC, 2006).

Although SOX's focus on internal controls over financial reporting is under the consideration of a cost-effective solution of reinforcing compliance and accountability in response to accounting scandals, all enterprise-wide risks, not just the risks existing in reporting systems, affect the reliability of financial reporting (Lin and We, 2006). Therefore, to comply with SOX's requirement on internal control over financial reporting,

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[7] Turnbull (1999) defines internal control as a system, which encompasses the policies, processes, tasks, behaviors and other aspects of a company that taken together:
- Facilitate its effective and efficient operation by enabling it to respond appropriately to significant business, operation, financial, compliance and other risks to achieving the company's objectives.
- Help ensure the quality of internal and external reporting.
- Help ensure compliance with applicable laws and regulations, and also with internal policies with respect to the conduct of business.

companies will have to disclose weaknesses in internal controls covering the objectives

of reporting, operations and compliance in COSO (1992) and Turnbull (1999).

The above fact, thus, provides motivation to further classify an internal control into

reporting-only internal control (FRIC) and *more-than-reporting internal control*

(MTRIC). I define a FRIC as internal control merely related to the objective of reliable

reporting and a MTRIC as internal control related to reporting objective plus some other

objectives such as operations and compliance stated in COSO (1992) and Turnbull (1999).

In terms of the analysis based on Ohlson (1995) model, the negative impact of the

disclosures of weak internal controls on firm value may arise from three factors: higher

cost of capital, lower precision of accounting information, and lower effectiveness and

efficiency of business operations. A disclosure of deficiencies in FRIC may simply

contribute to the first two factors, while deficiencies in MTRIC may contribute to all

three factors to reduce the firm value. Therefore, I hypothesize that the disclosures of

material weaknesses in FRIC are more negatively related to firm value than material

weaknesses in MTRIC.

Hypothesis 2: The disclosures of material weaknesses in more-than-reporting internal

controls are more negatively associated with firm value than the

material weaknesses in reporting-only internal controls.

The second hypothesis is also suggested in the literature. Based on a survey study,

Hermanson (2000) finds that respondents strongly agree that a management report on

internal control using a broad rather than a narrow definition of internal controls can

improve controls and provide a better indicator of a company's long-term viability.[8] The

Government Accountability Office (GAO) has also asserted that public reporting on

internal control should choose the broad definition of internal control, instead of the

narrow definition, to better serve public interest (Kelley, 1993).

2.4 Methodology

2.4.1 Identifying and classifying firms with material weaknesses

I performed a comprehensive textual keyword search of public filings using

10kwizard.com. Specifically, I search the keyword "material weakness!" from August 29,

2002 to March 31, 2006.[9] I read through each SEC filing to ensure a material weakness in

internal control is disclosed. For instance, some firms reported significant deficiencies,

reportable conditions, or risk factors, but these did not rise to the level of material

weakness. This research focuses on material weaknesses for two reasons. First, it is the

most severe type of deficiency in internal control and the most likely to affect market

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[8] In Hermanson (2000), a narrow definition of internal control limits to financial reporting purpose only and is correspond to the FRIC in this chapter, while a broad definition of internal control goes beyond financial reporting to include operations and compliance controls and is correspond to the MTRIC in this chapter.
[9] The exclamation "!" in "material weakness!" is to allow the keyword search to include both "material weakness" and "material weaknesses."

valuation. Second, the disclosure of material weakness is mandatory, while the disclosure

of lesser "significant deficiencies" is voluntary. Focusing on mandatory disclosures helps

avoid self-selection issues associated with voluntary disclosures. I also eliminated

observations that disclose no newfound material weakness in the current year, but only

report the follow-ups to remediate the previous material weaknesses. This procedure

identifies 1,585 disclosures (from 1,396 firms) of material weaknesses from August 2002

to March 2006 (Table 2.1). I eliminate 364 cases that are disclosed in 10Qs and 8Ks

while not disclosed in annual report or its amendment, because the analysis of this study

is at the firm-year level. I further eliminate 181 firm-years in the material weakness

sample that are not covered by Compustat. Finally, 306 firm-years have insufficient data

for the analysis of market valuation, resulting in a final sample of 708 firm-years with

material weakness covering 2002 to 2005.

To form a control group without any concerns of material weakness to stockholders,

I start with all available 23,750 firm-years from 2002 to 2005 in Compustat. Among the

23,750 firm-years, 5,024 firm-years related to the initial 1,396 material weakness firms

are eliminated. 5,273 firm-years are further deleted because of missing data for the tests. I

also delete outliers of 247 firm-years identified by one percent of each financial variable

in the residual income model. This process identifies a control group of 13,206 firm-years

from all Compustat firms that never disclosed any material weakness throughout the

testing period. Therefore, the final sample of firms consists of 708 material weakness

firm-years and 13,206 control firm-years. Table 2.1 summarizes the sample selection

process.

To test the second hypothesis, I classify material weaknesses sample as disclosing a

material weakness in either FRIC or MTRIC. FRICs are internal controls related to the

process of summarization, measurement, and estimation of financial information, such as

application of GAAP and financial statement closing procedures. MTRICs are internal

controls related not only to the financial reporting but also to business operations, asset

safeguarding, or regulation compliance. Examples of each category can be found in

Appendix 2.A. These classifications are mutually exclusive; if a firm discloses

weaknesses in both FRIC and MTRIC, I code this disclosure as having weaknesses in

MTRIC.

2.4.2 Empirical Model and Data

Based on Ohlson (1995), Equations (2.1a), (2.1b), and (2.1c) discussed in

hypotheses section can be modified as follows:

$$MV_t = BV_t + \alpha_1 AE_t + \alpha_2 V_t \tag{2.2}$$

where MV_t is the firm's market-value,

BV_t is the firm's book value,

AE_t is abnormal earnings $= NI_t - R_t BV_{t-1}$,

NI_t is net income in t,

R_t is the discount rate,

V_t is non-accounting information used in the prediction of future abnormal

earnings, and

α_1 and α_2 are parameters describing the process that generates future abnormal

earnings under the model's assumptions.[10]

A disclosure of material weaknesses in internal controls represents one of the

factors to reduce V_t, because weak internal controls, as discussed in Section 2.3, may

reduce market's expectation on future abnormal earnings by increasing the firm's cost of

capital, decreasing precision of financial reporting, and decreasing the efficiency and

effectiveness of business. Therefore, following prior studies that study the value

relevance of accounting information (e.g., Amir, 1993; Sougiannis, 1994; and Tse and

Yaansah, 1999), the theoretical accounting-based valuation model in equation (2.2) is

adapted to measure the relation between the disclosures of material weaknesses in

internal control and the firm's market valuation in the empirical setting as follows:

$$MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 MW_t + \sum_{i=1}^{n} \beta_{4i} Industry_i + \sum_{j=1}^{T} \beta_{5j} Year_j + \varepsilon_t \quad (2.3)$$

where MV_t is the firm's market-value,

TA_t is the firm's total assets,

---

[10] Mainly, these assumptions are AR(1) linear information generating processes and clean surplus accounting in which all changes in retained earnings go through the income statement. Ohlson (1995, 2001), Feltham and Ohlson (1995) and Hand (2001) provide detailed derivations of the full valuation model.

BV_t is the firm's book value,

AE_t is abnormal earnings = $NI_t - R_t BV_{t-1}$,

NI_t is net income in t,

R_t is the discount rate,

MW_t is set to one if a firm has disclosure of material weakness in annual reports
in time t, zero otherwise,

$Industry_i$ is set to one if a firm is in industry i, zero otherwise,

$Year_j$ is set to one if a firm-year is in year j, zero otherwise.

β_0 through β_{5T} are coefficients of the model, and

ε_t is the error term.

MV_t is basically the market-value of equity 3 months after year end t. The 3-

month lag is to allow time for the reported financial information and the disclosed

material weaknesses in internal controls to be available to the market, as this detail is not

available until the full annual report is released. However, Ettredge et al. (2006) suggest

that material weakness firms may delay their disclosures of material weaknesses in

annual report or amendments for annual report after SEC's filing deadline of annual

report (i.e., 3 months after year end). The market may not know about the information of

material weakness on the filing deadline of the annual report if the firm delays the actual

filing date. Therefore, for material weakness firms that delayed their disclosures of

material weaknesses in internal controls, the market-value on the actual filing date is used.

All related data for market-value is from CRSP database. BV_t (Compustat #216) is the

book value of equity at year end t. AE_t represents the "abnormal earnings" for year t,

measured by net income (Compustat #58) for the current year less discount rate R_t times

BV_{t-1}, where R_t is measured as the average of the 12 monthly interest rates of 5-year

government notes in year t (data for R_t is from Compustat). TA_t (Compustat #6) is the

total assets at year end t and, as a variant of Ohlson's valuation specification, is used to

deflate market-value, book value, and abnormal earnings. Literature related to the

determinants of deficiencies in internal control shows that one of the significant factors is

the firm size. Market-value or logarithm of market-value, when chosen as the proxy for

firm size, is found negatively determining the incidence of deficiencies in internal control

(Bryan and Lilien, 2005; Doyle et al, 2005; and Ge and McVay, 2005). Total assets are

used in this study as the deflator to minimize the size effect because Krishnan (2005a)

shows that total assets is the proxy for firm size and is found positively related to the

probability of deficiencies in internal control. MW_t is set to one if a firm discloses

material weakness in year t, zero otherwise. $Industry_i$ is set to one if the firm is in a

particular industry, zero otherwise. Industry classification is following Barth et al (1998),

which identifies 15 industries based on the first two digits of firms' SIC codes. $Year_j$ is

set to 1 for the current year or 0 if otherwise.

In the theoretical valuation model, "other information" V_t includes all information

outside the financial statements that the market uses to develop its expectations

concerning future abnormal earnings. MW_t, $Industry_i$, and $Year_j$ are used in this study to

proxy for "other information" in equation (2.2). According to Hypothesis 1, the

disclosures of material weaknesses will be negatively associated with firm value. MW_t is

therefore hypothesized as one factor in other information that has negative effect on

market's prediction of future abnormal earnings. A negative coefficient of MW_t (i.e.,

$\beta_3 < 0$) in equation (2.3) will provide support for Hypothesis 1. The industry in which a

company primarily operates may influence expectations on future abnormal earnings.

Each year contains different microeconomic background and may also affect these

expectations. Thus, $Industry_i$, and $Year_j$ are used to control for all possible correlated

omitted factors such as time series parameters of earnings process, systematic risk and

environmental factors to ensure the coefficients in the empirical model are not biased.

Disclosures of material weaknesses in internal controls can be further categorized

into disclosed weaknesses in FRIC and MTRIC. Therefore, MW_t in equation (2.3) is

replaced by FR_t and MTR_t to form the following equation (2.4):

$$MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 FR_t + \beta_4 MTR_t + \sum_{i=1}^{n} \beta_{5i} Industry_i + \sum_{j=1}^{T} \beta_{6j} Year_j + \varepsilon_t \quad (2.4)$$

where MV_t, TA_t, BV_t, AE_t, $Industry_i$, $Year_j$ are defined the same as in equation
(2.3),

FR_t is set to one if a disclosure of material weaknesses in reporting-only
internal controls (FRIC), zero otherwise,

MTR_t is set to one if a disclosure of material weaknesses in more-than-reporting internal controls (MTRIC), zero otherwise,

β_0 through β_{6T} are coefficients of the model, and

ε_t is the error term.

Hypothesis 2, which states that the disclosures of material weaknesses in MTRICs will be more negatively associated with firm value than the material weaknesses in FRICs, predicts that the coefficient of the dummy variable MTR_t should be more negative in terms of significance and magnitude than the coefficient of FR_t (i.e., $\beta_3 < 0$, $\beta_4 < 0$, and $\beta_4 < \beta_3$).

2.4.3 10K-Only Material Weakness Sample

Among the full sample of 708 material weakness disclosures, 106 disclosures of internal control weakness are listed in 10K amendments, 6 in 10KSBs, and 2 in 10KSB amendments. These 114 disclosures are further eliminated from the material weakness sample to form a "10K-only material weakness sample" of 594 disclosures. The sub-sample consisting of 10K-only material weakness disclosures is selected to address the possible concerns of market timing of the disclosures of material weakness, effect of interim reports, and resource constraints for smaller firms. First, management of a firm might manipulate the timing of the information to the public by delaying the disclosures of material weakness after the original annual report. More specifically, a management

can technically comply with section 404 of SOX by reporting internal controls in amendment of annual report. However, since the market's focus might be more on 10K than its amendments, management might have the incentives to lessen the punishment of negative market valuation by delaying the timing of the disclosures of material weaknesses to a less focused timing.

Second, the information background might have changed between 10K and its amendments. For example, a firm's 10Qs or 8Ks might be filed between the firm's 10K and its amendment, which deviates from the information setting in the residual income model in this study. More specifically, MV on the date of amendments of 10Ks may become the function of the updated BV and AE after including all information since the firm's 10K filing, while not be the function the year-end BV and AE in the empirical model.

Third, disclosed material weaknesses of internal control in 10KSB and it amendments mostly mention about the shortage of resources and personnel in internal controls, while according to COSO (1992), small and mid-size companies may have less formal and less structured controls and still have effective internal controls. In other words, some material weaknesses disclosed in 10KSB and its amendments should not be considered material weaknesses for small firms.

To summarize, I use the identified 10K-only material weakness sample of 594 firms to control for the possible management manipulation of timing, informational background, and different resources requirements for small firms' internal controls. This controlling test intends to move closer to the theoretical setting of my empirical model to evaluate the impact of disclosures of material weaknesses in internal controls on firm value.

2.4.4 Potential Self-selection Bias

Another necessary control test in this study is due to the fact that the variable of interest, MW_t, may not be exogenous, because firms might choose both their internal controls and their effort to discover and disclose any known weakness (Ashbaugh et al, 2006). In this study, I focus only on material weaknesses, the most severe kind of deficiencies in internal control, which are required to disclose under SOX, thereby eliminating the choice of disclosure of weak internal controls. However, using mandatory disclosures of material weaknesses in my sample only addresses the problem of firms' choices to disclose. Firms might have choices to maintain and detect weaknesses in their internal controls as well.

To correct for firm's self-selection of maintaining and detecting internal controls, two methodologies are used: 1) Heckman two-stage estimation method (Heckman, 1978),

and 2) propensity score matching. The Heckman two-stage method starts with estimating

a probit regression of MW_t on the determinants of material weaknesses. I choose five

determinants for the first stage regression by consulting literature on determinants of

deficiencies in internal controls (Bryan and Lilien, 2005; Doyle et al, 2005; Ge and

McVay, 2005; and Krishnan, 2005a). These five determinants are described as follows:

First, the size of a firms, TA, is measured as the firm's total assets in year t. Second, the

profitability indicator of a firm's financial health, measured as an indicator variable,

AGGREGATE LOSS, which equals to one if earnings before extraordinary items

[Compustat #18] in year t and t-1 sum to less than zero, zero otherwise. Third, whether a

firm engages in more complex transactions, measured as an indicator variable *FOREIGN

TRANSACTIONS*, which equals to one if the firm has a non-zero currency transaction

[Compustat #150] in year t, zero otherwise. Fourth, a firm with rapid growth, measured

by variable *SALES GROWTH*, the sales [Compustat #12] in year t minus the sales in year

t-1 and then divided by sales in year t-1. Finally, whether a firm is undergoing substantial

restructuring, measured by variable *RESTRUCTURING CHARGE*, the restructuring

charge [Compustat #376 $\times$ (-1)] in year t scaled by firm's total assets. Using the 10K-

only material weakness sample and the control sample, this probit regression estimates

the likelihood of disclosing a material weakness and the results are presented in

Appendix 2.B. Based on the first stage estimation, the inverse Mills ratio is calculated

following Heckman (1979). MW_t is then replaced with this ratio in the empirical model

(2.3). The inclusion of the ratio in the main regression helps control for the likelihood of

self-selecting into the material weakness group.

The second methodology to account for the potential self-selection of weak

internal controls is to use a matched sample, based on the same industry, the same year,

and the nearest predicted value from the above probit model. This method, known as

propensity score matching (LaLonde, 1986), uses the predicted value from the probit

model to measure a firm's propensity of weaknesses in internal controls. Self-selection

problem is controlled by matching two firms with the same propensity of weakness in

internal control, while one discloses and the other does not. The propensity score

matching method produces a matched sample of 594 control firm-years.

2.5 Empirical Results

2.5.1 Descriptive Statistics and Univariate Analysis

Figure 2.1 provides the time series of the yearly averaged market-value deflated

by total assets (MV/TA) for 10K-only material weakness group and control group. From

2002 to 2005, the series of the weakness firms are consistently lower than the series of

the control group. This suggest, over the testing period, weakness firms have lower scale-

free market-value than non-weakness firms, providing preliminary evidence to the

relation between internal control and firm value.

Table 2.2 represents descriptive statistics for the material weakness sample and

Compustat control sample without disclosing any material weakness in internal control

from August 2002 to March 2006. I also report the results of a two-tailed t-test for the

difference in means of the two groups for each of the variable. From these univariate

results, MV, BV, and AE are all lower for material weakness firms at a significant level of

5%. Lower MV for material weakness sample confirms the findings in literature that

firms with smaller market-value have more chance of deficiencies in internal control

(Bryan and Lilien, 2005; Doyle et al, 2005; and Ge and McVay, 2005). After considering

the size effect, the t-test shows that MV/TA and BV/TA have p-values 0.911 and 0.722,

respectively, meaning size effect is well addressed and should not be the concern in the

market valuation model. However, AE/TA is still significantly lower for material

weakness sample after I control for size effect. This might be due to the following two

reasons. First, this implies, after controlling for scale factor, weak internal controls till

shows negative impact on a firm's ability of managing operations to earn residual income.

Second, poorly performing firms simply may not be able to adequately invest time and/or

money in proper internal controls (Krishnan, 2005a).

By the univariate results of determinants for deficiencies in internal control,

material weakness firms have higher aggregate loss, more foreign transactions, and

higher sales growth than the control sample.

Table 2.3 presents a correlation matrix among the main variables. Material

weakness firms are positively correlated with more aggregate loss, more foreign

transactions, and higher sales growth, and are negatively correlated with abnormal

earnings. Overall, the correlation analysis confirms the univariate analysis that material

weakness firms have lower profitability, more complex operations, and higher sales

growth.

2.5.2 Main Findings

Table 2.4 presents the market valuation model (2.3), which regresses market-

value on book value, abnormal earnings, and a material weakness indicator variable, with

the control of a firm's industry and year. Financial variables are scaled by firm's total

assets. The regressions are estimated using Ordinary Least Square.

The deflated market-value (MV/TA) is presented as the dependent variable in

Table 2.4, with the following four model specifications. In the first column we present

the main regression using all material weakness firms and control sample. The second

column shows the main regression using the 10K only sample and control sample. In the

last two columns, I present results from using 10K-only material weakness firms and

control sample for two control tests, in order to address the self-selection bias discussed in Section 2.4.4. The control tests for self-selection bias are denoted as Inverse Mills Ratio and Propensity Score Match under the "Selectivity Control Method."

All coefficients across all four model specifications conform to the predicted signs significantly. More importantly, the main variable of interest, MW, is negatively related to the market-value across all four specifications, supporting Hypothesis 1, and suggesting disclosures of material weakness in internal control are negatively related to firm value.

2.5.3 Analysis by Material Weakness Type

Table 2.5 reports the regression results on the relation between market-value and the different types of internal control deficiencies. Recall that Hypothesis 2 predicts that material weaknesses in MTRIC will have a stronger negative relation with market-value than in FRIC, because from the analysis of residual income model, a deficiency in FRIC affects market's cost of capital and variance of financial measurement errors, while deficiency in MTRIC, besides the above two effects, affect efficiency and effectiveness of business operating as well.

Referring to Table 2.5, across all three specifications the coefficients of the indicator variables for material weaknesses in FRIC and MTRIC, FR and MTR, are

negatively related to market-value. More importantly, all three specifications the

coefficients of *MTR* are more negative than those of *FR*, in terms of magnitude

(Coefficients for *FR* versus *MTR* under three specifications are -141.607 versus -

181.827, -146.323 versus -193.899, and -112.401 versus -335.770, respectively) and

significance (P-values of coefficients for *FR* versus *MTR* under three specifications are

0.021 versus 0.007, 0.035 versus 0.006, and 0.579 versus 0.102, respectively). These

results support the second hypothesis: material weaknesses in FRIC are more negatively

related to market-value than material weaknesses in MTRIC.

     This finding implies the value of those internal controls other than the reporting-

only internal controls and complements COSO (1992) and Turnbull (1999)'s frameworks

that encompass the objectives of internal controls in business operations and compliance,

beyond the objective of internal controls in financial reporting. In addition, the above

finding also supports Hermanson (2000) who found that a management report on internal

control using a broad rather than a narrow definition of internal controls can improve

internal controls and provide a better indicator of a company's long-term viability.

2.6 Additional Tests

2.6.1 Alternative Classification of Material Weaknesses

COSO (1992) is unanimously referred by all companies in their annual reports as the model for evaluating their internal controls (Gupta and Thomson, 2006). COSO framework (1992) has identified five interrelated components of internal control: control environment, risk assessment, control activities, information and communication, and monitoring. Of those components, "the control environment sets the tone of an organization, influencing the control consciousness of its people. It is the foundation for all other components of internal control, providing discipline and structure" (COSO, 1992). On the other hand, Hammersley et al (2007) suggests control environment weaknesses are more difficult for the auditor to audit and these types of weaknesses cause more serious concerns to the market. Therefore, the first additional test is to study whether weaknesses related to control environment have a larger negative effect on firm value than the weaknesses found in the other four components.

To empirically test this question, I use five indicator dummies, E, R, A, I, and M to represent whether the weakness arises from any of the five COSO (1992) of internal control- control environment, risk assessment, control activities, information and communication, and monitoring, respectively. Each material weakness might result from

deficiencies in more than one of the five components. I provide definition and examples

of this assignment of indicator variables in Appendix 2.C. After the above classification,

MV in the market valuation model (2.3) is replaced with the five indicator variables to

form the following equation (2.5).

$$MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 E_t + \beta_4 R_t + \beta_5 A_t + \beta_6 I_t + \beta_7 M_t + \sum_{i=1}^{n} \beta_{8i} Industry_i + \sum_{j=1}^{T} \beta_{9j} Year_j + \varepsilon_t \quad (2.5)$$

where MV_t, TA_t, BV_t, AE_t, $Industry_i$, $Year_j$ are defined the same as in equation
(2.3),

E_t is set to one if a disclosure of material weaknesses is related to control environment and zero otherwise,

R_t is set to one if a disclosure of material weaknesses is related to risk assessment and zero otherwise,

A_t is set to one if a disclosure of material weaknesses is related to control activities and zero otherwise,

I_t is set to one if a disclosure of material weaknesses is related to information and communication and zero otherwise,

M_t is set to one if a disclosure of material weaknesses is related to monitoring and zero otherwise,

β_0 through β_{9T} are coefficients of the model, and

ε_t is the error term.

If material weaknesses related to control environment are more negatively

associated with firm value than weaknesses in the other four components of internal

control, in equation (2.5) the coefficient of E (i.e., β_3) will be more negative than the

coefficients of R, A, I, and M (i.e., β_4 to β_7).

Table 2.6 presents the results under three model specifications the same as in

Table 2.5. Across all three specifications, the only significant case is the weaknesses in

control activities (A) using all material weakness firms (with coefficient -161.882 and p-

value=0.053). The mixed results might be due to that these five components in COSO

framework (1992) are interrelated, therefore each material weakness might be in fact

related to "all five" components. The other factor contributes the mixed results might be

the measurement errors of the coding process. I code the five indicator variables by

reading the text of each disclosure. This process might not fairly reflect the components

related to each weakness, since firms can choose which components to mention in their

disclosure. This coding process may be unfair for companies disclosing more extensive

information of their material weakness, since a more-detailed description increases the

number of components being coded.

2.6.2 Repetitive Occurrences of Material Weaknesses

In Section 2.3 the disclosures of a weakness in internal control is analyzed as

having negative impacts on the market's expectation of future abnormal earnings.

However, all the material weakness firms disclose remediation plans to address their

disclosed material weaknesses in internal controls. The existence of a remediation plan

for the weak internal control might make the market revise the original negative

expectations from hearing control deficiencies to be more optimistic, since the firm has

the ability to detect the problems in internal controls and is planning to correct the found

weakness in internal control.

It's not feasible to directly test the value of the remediation plan, because

material weaknesses in internal control and the related remediation measures are always

disclosed together by firms. My identification strategy is to find from the 10K-only

material weakness sample 38 disclosures that the same firm has prior history of

disclosing material weaknesses in internal control during August 2002 and March 2006.

The indicator dummy *Occur* is set to one for these 38 repetitive occurrences of material

weakness in internal control, and is set to zero for the rest of the 594 disclosures. I

hypothesize that repetitive occurrences of deficiencies in internal control arise from an

ineffective remediation plan, which results in lower market expectation of future

abnormal earnings than an effective remediation. *Occur* is therefore expected to be

negatively associated with market-value if included in the market valuation model, as

shown in the following equation (2.6).

$$MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 Occur_t + \varepsilon_t \qquad (2.6)$$

where MV_t, TA_t, BV_t, AE_t are defined the same as in equation (2.3),
$\quad Occur_t$ is set to one if a repeat disclosure of material weaknesses and zero
$\qquad$ otherwise,

β_0 through β_3 are coefficients of the model, and ε_t is the error term.

The first model specification in Table 2.7 shows this regression results from using 594 observations of 10K-only material weakness sample. The second and third model specifications further control for two interaction terms, $Occur \times MTR$ and $Occur \times E$. The fourth model specification controls the self-selection bias by inverse Mills ratio, using the same determinants for MW (Estimation from the first-stage regression is shown in Appendix 2.C). Those determinants are supposed to be able to predict an ineffective remediation plan.

The results across four model specifications are mixed and insignificant. The association between firm value and the repetitive occurrences of weak internal controls are inconclusive, suggesting an unclear picture about the value of the remediation plan for weaknesses in internal controls.

2.6.3 Material Weaknesses Disclosed in Annual Report versus in its Amendments

Section 2.4.3 describes the control for 10K-only material weakness sample by excluding disclosures of material weakness of internal control in amendments of annual reports. This additional test investigates whether the market valuation concerns the possible management's manipulation of the timing of disclosures of material weaknesses

by delaying to the amendments of annual reports. An indicator variable *Amend* is set to one if a disclosure of material weakness is in 10K amendment (106 disclosures), or is set to zero for the 10K-only material weakness sample (594 disclosures).

The results are presented in Table 2.8. Although not significant, the coefficients of *Amend* are negatively related to market-value when we consider *Amend* and its interaction terms, $Amend \times MTR$ and $Amend \times E$. The coefficient of *Amend* becomes significantly negative (coefficient -2,642.128 and p-value 0.001) when I use inverse Mills ratio to control for the possible self-selection problem of choosing to disclose in the amendment or not.[11] This result suggests that the delaying the disclosure of material weaknesses to amendments of annual reports is negatively associated with firm value, supporting market's concerns about management's manipulation.

2.6.4 Voluntary vs. Non-voluntary Disclosures of Material Weaknesses

Even though Section 404 of SOX mandates firms to disclose material weaknesses in internal controls, many accounting academicians lean in favor of free markets system and therefore prefer voluntary disclosure as opposed to mandatory disclosure (e.g., see Benston, 1969). On the other hand, the value of mandatory disclosure

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[11] Here we use the same set of determinants for MW. Estimation from the first-stage regression is shown in Appendix 2.B. Those MW determinants are assumed to be able to determine the delay of a disclosure of material weaknesses in the amendment of annual report.

regulation is an important question because disclosure regulations are an important

regulatory tool. If the costs of these rules exceed their benefits, as some suggest about the

recent Sarbanes-Oxley regulations, then perhaps voluntary disclosures remain preferable

(Romano, 2005). Hermanson (2000) also concludes that respondents agree about the

value of voluntary management reports on internal controls, but are neutral about the role

of mandatory management reports on internal controls in enhancing decision-making.

Most observations in the material weakness sample are mandatory disclosures.

However, some disclosures in material weakness sample represent firm's voluntary

disclosures of their material weaknesses in internal controls and they can be identified by

checking the effective date of Section 404 of SOX.[12] A group of 131 voluntary

disclosures of material weaknesses are identified if, firstly, they are disclosed in the

annual reports with year ending before November 15, 2004, and, secondly, they are

disclosed in 10KSB or its amendments. An indicator variable VD is set to one for

voluntary disclosures, or set to zero for mandatory disclosures. If voluntary disclosures of

material weaknesses are preferable by the market, VD in the market valuation model

should be expected to have a positive coefficient.

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[12] Section 404 of SOX became effective for accelerated filers for fiscal years ending after November 15, 2004. Accelerated filers are companies with worldwide market-values of at least $75 million, who have filed at least one annual report under Section 13(a) or 15(d) of the Exchange Act, and who are not eligible to file quarterly or annual reports on Forms 10QSB or 10KSB. On September 21, 2005, the SEC postponed the requirement to comply with Section 404 for non-accelerated filers until fiscal years ending after July 15, 2007.

Table 2.9 shows the results. Besides the main model (Model 1), interaction terms (Model 2 and Model 3) and inverse Mills ratio (Model 4) are added as control variables for the other three model specification.[13] Contrary to my expectation, the coefficients of VD in the first three models have negative signs, although insignificant. However, after controlling for the self-selection problem, the coefficient of VD becomes significantly positive (coefficient 3,102.96 and p-value 0.001), which conforms the expectation that the market prefers the voluntary disclosures of material weaknesses to the mandatory ones.

2.7 Conclusion

I use the residual income model as the market valuation model to examine the relation between market-value and internal control and find that firms with weak internal control have to lower market-value. The weak internal control firm-years are identified as those disclosing of material weakness in internal control in annual reports from August 2002 to March 2006. The relation between weak internal controls and lower market-value holds after controlling for a 10K-only material weakness sample. Moreover, the results

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[13] I use the same set of determinants for MW. Estimation from the first-stage regression is shown in Appendix B. This arrangement supposes those MW determinants can also be used to determine the voluntary disclosures of material weaknesses in annual report.

are robust to corrections for self-selection bias using both the inverse Mills ratio approach and propensity score matching.

I also find that the negative relation between market-value and internal control is stronger when the internal control problems are related to more-than-reporting internal controls (MTRICs) versus reporting-only internal controls (FRICs).

Finally, I conducted additional tests to further explore the market valuation of internal controls. First, I test whether market evaluates differently if weaknesses are related to different control components in COSO (1995). Second, I test whether repetitive weaknesses imply weak remediation measures and results into lower market valuation. Third, I test whether market concerns about the disclosures of weakness being postponed to amendments of 10Ks. Fourth, I test whether market favorably evaluate a voluntary disclosure of weaknesses in internal controls. Results for the last two additional tests are significant after correcting the self-selection bias. These results suggest market concerns about the disclosures of weak internal controls being delayed to amended 10Ks and market positively valuates the voluntary disclosures of weak internal controls.

A potential limitation of this study is the use of the disclosure of a material weakness as the proxy for the underlying construct of having an internal control problem. Therefore, to the extent that there is a systematic bias in the choice to identify and

disclose material weaknesses, the sample in this study may not represent the true

underlying population of internal control problem firms.

Empirical findings here have implications for regulators, researchers, and

practitioners. First, it appears that internal control is a fundamental driver for firm-value,

but largely untestable prior to the introduction of SOX. Second, the research finding adds

to the debate on the benefits of SOX, suggesting that the SOX's efforts to promote better

internal controls can actually create firm value. Third, firm value can be further created if

firms do not limit their internal controls for the objective of reporting reliability.

Chapter 3 Enterprise Risk Management and Firm Performance

3.1 Introduction

An argument growing throughout the existing literature in accounting and financial management is that the implementation of an enterprise risk management (ERM) system will improve firm performance (e.g., see COSO, 2004; Hoyt et al, 2006; Nocco and Stulz, 2006). There is, however, very limited empirical evidence confirming this relation between ERM and firm performance. Furthermore, the empirical evidence that does exist suggests that the appropriate ERM system may vary across firms (e.g., see PwC, 2004; Beasley et al. 2005; Hoyt et al, 2006). In other words, the relation between ERM and firm performance is most likely contingent upon several firm-related factors.

The primary objective of the study reported in Chapter 3 is to empirically examine the argument that the relation between ERM and firm performance is contingent upon the appropriate match between a firm's ERM and the following five factors impacting the firm: environmental uncertainty, industry competition, firm complexity, firm size, and monitoring by the firm's board of directors. This argument is examined based on an empirical study of 124 U.S. firms that disclose their ERM activities in their 10K reports for 2005 with the U.S. Security and Exchange Commission (SEC). The

findings from the study provide strong evidence that the relation between ERM and firm performance is contingent upon the appropriate match between a firm's ERM system and the five factors noted above.

Firms have the choice of implementing an ERM system and, if they do, they can also decide whether to disclose any information about their ERM. Our results are robust to the correction of self-selection problem by using a propensity matched sample. Specifically, a probit regression model with ERM adoption as a function of its determinants is estimated for the calculation of the propensity score. Non-ERM firms in the same industry with the closest propensity scores are selected as the control group. A dummy variable is created to indicate whether a firm belongs to ERM group or control group. This dummy is then included in our analysis as a control variable to control for the self-selection of adopting and disclosing ERM. After controlling for the self-selecting problem, our results still support the argument that the relation between ERM and firm performance is contingent upon the appropriate match between a firm's ERM system and the five contingency factors.

The remainder of Chapter 3 will proceed as follows. In the next section the basic hypothesis underlying the empirical study is developed. The design of the empirical study

to test this basic hypothesis is discussed in the third section of the paper. The fourth

section discusses the results of the empirical study. The fifth section shows the robustness

checks. The sixth, and final, section of the paper discusses the implications of the study

and direction for future research.

3.2 Basic Argument

Enterprise risk management focuses on adopting a systematic and consistent

approach to managing all of the risks confronting an organization. Indeed, ERM is

considered by many as the fundamental paradigm for managing the portfolio of risks

confronting organizations (e.g., see Liebenberg and Hoyt, 2003; Beasley et al, 2005;

O'Donnell, 2005; Nocco and Stulz, 2006). From a managerial accounting perspective,

ERM can be thought of as falling under the umbrella of the value-based management

approach that provides an integrated framework for measuring and managing an

organization, with the explicit objective of creating long-term value for the organization[14].

Gordon and Loeb (2006, p. 106) define ERM as follows:

> Enterprise risk management refers to the overall process of managing an
> organization's exposure to uncertainty with particular emphasis on identifying
> and managing the events that could potentially prevent the organization from
> achieving its objective. ERM is an organizational concept that applies to all levels
> of the organization.

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[14] See Ittner and Larcker (2001) for an excellent discussion of the value-based management philosophy.

The most popular definition of ERM in the accounting literature (e.g., see Beasley

et al, 2005) is, however, the one provided by COSO (2004). According to COSO (2004, p.

2),

> Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

According to COSO (2004), the effectiveness of an organization's ERM needs to

be judged in terms of the following four objectives.

1. Strategy: high-level goals, aligned with and supporting its mission.
2. Operations: effective and efficient use of its resources.
3. Reporting: reliability of reporting.
4. Compliance: compliance with applicable laws and regulations.

The above definition and objectives of ERM provided by COSO (2004) are in

large part, based on COSO's (1992) framework for internal control (IC). The one major

difference is that COSO's notion of ERM includes a strategy element not included in its

IC framework. Thus, when viewed in these terms, the objectives of ERM specified by

COSO are clearly an extension of an organization's management control system. In

developing the guidelines for implementing the Sarbanes-Oxley Act (SOX) of 2002, the

original intent of the U.S. Securities and Exchange Commission was to take the broader

view of IC that parallels the IC framework provided by COSO (1992). However, the final

version of SOX limits its IC requirement to COSO's notion of financial reporting

reliability.[15] This latter fact notwithstanding, most major corporations take the broader

view of management control systems rather than the narrow IC view required by SOX.

Thus, an unintended positive consequence of SOX is a move toward an ERM philosophy

by many major corporations.

In developing its ERM framework, COSO (2004) specifies eight components to

achieve the attainment of the aforementioned four objectives: strategy, operations,

reporting, and compliance. These eight components are: internal environment, objective

setting, event identification, risk assessment, risk response, control activities, information

and communication, and monitoring. The COSO framework points out that the role of

these eight components will vary depending on the size of organization. In essence,

COSO points out that the costs and benefits of an ERM system will vary from firm to

firm, depending on the above components and the size of the firm. Thus, COSO's (2004)

ERM framework clearly implies a contingency perspective toward the net benefits a firm

will derive from its ERM system. In other words, the most cost effective ERM system for

a particular firm may vary substantially from the ERM system that is cost-effective for

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[15] Section 302, 404, and 906, of the Sarbanes-Oxley Act of 2002, provide the specific requirements related to an organization's internal control for firms filing with the SEC.

another firm. This view is, of course, consistent with the accounting literature that applies

contingency theory to management control systems (e.g., Gordon and Miller, 1976; Otley,

1980; Gordon and Narayanan, 1984; Merchant, 1984; Chenhall and Morris, 1986; Mia

and Chenhall, 1994; Shields, 1995; Chenhall, 2003).

Not surprisingly, determining which factors are key in determining the

contingency nature of a firm's ERM system and its performance is far from an exact

science. However, based on the existing literature, it seems fair to assume that at least

five factors are critical to understanding the relation between ERM and firm performance.

These five factors are: environmental uncertainty, industry competition, firm size, firm

complexity, and monitoring by the firm's board of directors. The rationale underlying the

importance of each of these factors is discussed below.

3.2.1 Environmental Uncertainty

The importance of considering the environmental uncertainty (*EU*) confronting an

organization when designing management control systems (which include an ERM

system) is well established in the accounting literature (e.g., see Gordon and Miller, 1976;

Gordon and Narayanan, 1984; Chenhall, 2003). Environmental uncertainty creates

difficulties in management control systems due to the fact that it creates increases in the

unpredictability of future events. Thus, the risks confronting a firm and the appropriate

response to such risks will vary depending on the EU confronting the firm. Since an ERM system is intended to identify and manage future unpredictable events that may adversely affect an entity, as environmental uncertainty increases obstacles to cost-effective ERM activities may also increase. In addition, as environmental uncertainty increases, the need for incorporating broad scope information into an ERM control system will also likely increase (e.g., see Gordon and Narayanan, 1984; and Chenhall and Morris, 1986; Mia and Chenhall, 1994). Thus, the proper match between a firm's ERM and the EU confronting the firm is likely to impact the relation between a firm's ERM system and its overall performance (i.e., the net benefits and costs). Accordingly, the environmental uncertainty confronting a firm is one factor that is considered in the study reported upon in Chapter 3.

3.2.2 Industry Competition

Industry competition is another factor that seems critical when considering the relation between a firm's performance and its ERM system. Khandwalla (1972), for example, found that the sophistication of a firm's control (i.e., monitoring) system is highly correlated with the intensity of competition. It seems reasonable to assume that the proper match between industry competition and a firm's ERM system will have an effect on the relation between a firm's ERM system and performance. The evidence provided

by the PwC (2004) Survey supports this assumption. Accordingly, industry competition is another factor considered in the study reported upon in Chapter 3.

3.2.3 Firm Size

The relation between firm size and organizational structure has been a primary consideration in the organization theory literature for some time (e.g., see Lawrence and Lorsch, 1967). In addition, accounting researches have also found firm size an important factor when considering the design and use of management control system. Shields (1995), for example, finds large firms may have greater access to the resources needed to implement more complex systems. Hoyt et al (2006) find firm size to be positively related to the adoption of ERM. Beasley et al (2005) show that organizational size is positively related to the stage of ERM implementation. Merchant (1984) argues that organizational growth poses increased communication and control problems. Furthermore, as the size of a firm increases, the difficulty in implementing information and communication activities, as well as control activities, would also likely increase. Thus, the cost effectiveness of an ERM system is likely to vary with variations in firm size. In other words, the proper match between firm's size and its ERM system is likely to affect the relation between a firm's ERM and its performance. Accordingly, firm size is another factor that is considered in the study reported upon in Chapter 3.

3.2.4 Firm Complexity

Another factor that is likely to impact the relation between a firm's ERM system and its

performance is the notion of firm complexity. Firm complexity, as used in this paper,

refer to the numbers of line-of-businesses and geographical locations associated with a

firm. As pointed out by Merchant (1981), highly diversified and decentralized firms

require more administrative controls than their less diversified and decentralized

counterparts. Hoyt et al (2006) find that complexity (measured by industrial and

international diversification) is positively related to the use of ERM. Greater firm

complexity will, however, cause less integration of information and more difficulties in

management control within the organization. Doyle et al (2005) find material weaknesses

in internal control is more likely for firms that are more complex. Thus, the proper match

between a firm's complexity and its ERM system is likely to be another key concern in

assessing the relation between a firm's ERM and its performance. Accordingly, firm

complexity is another factor considered in the study reported upon in Chapter 3.

3.2.5 Board Monitoring

Kleffner et al. (2003) found that many Canadian companies adopting an ERM

strategy cited encouragement from the board of directors as the main factor underlying

such adoption. COSO (2004) also argues that the board of directors play an important

role in a firm's ERM strategy. Beasley et al (2005) find the proportion of independent

directors in the board is positively related to the stage of ERM deployment. In addition,

starting 2003 New York Stock Exchange (NYSE) Corporate Governance Rules include

explicit requirements for NYSE registrant audit committees to assume specific

responsibilities with respect to "risk assessment and risk management," including risks

beyond financial reporting (NYSE, 2003). Thus, the proper match between a firm's

board of director's monitoring activities and its ERM strategy is likely to affect the

relation between a firm's ERM and its performance. Accordingly, the monitoring

activities of a firm's board of directors is another factor that is considered in the study

reported upon in Chapter 3.

The above discussion suggests that, from a performance perspective, a firm's

choice of its ERM system should be properly matched with several key firm-related

variables. That is, there is a cost associated with an ERM system and the costs of

improving the effectiveness of such a system needs to be weighed against the incremental

benefits. In terms of a basic argument, the above can be stated as follows.

The relation between a firm's ERM and its performance is contingent on the proper match between a firm's ERM and the following five firm-related

variables: environmental uncertainty, industry competition, firm size, firm complexity and monitoring by the firm's board of directors.

The above basic argument which is illustrated in Figure 3.1, can be tested in terms of equations (3.1) and (3.2) specified below. Equation (3.1) describes the relation between ERM and the firm related variables discussed above. Equation (3.2) considers the relation between a firm's performance and the appropriate "match." Equation (3.2) is based on a residual analysis, whereby the absolute value of residuals (*ARES*) from equation (1) are regressed on firm performance.

$$ERM = \beta_0 + \beta_1 EU + \beta_2 CI + \beta_3 FS + \beta_4 FC + \beta_5 MBD + \varepsilon, \qquad (3.1)$$

where *ERM* = enterprise risk management,
EU = environmental uncertainty,
CI = competition within industry,
FS = firm size,
FC = firm complexity,
MBD = monitoring by firms board of directors,
β_i = various model parameters, *i*=0 to 5, and
ε = error term.

$$P = \beta_0 + \beta_1 ARES + \varepsilon \qquad (3.2)$$

where *P* = firm performance,
ARES = absolute value of residuals from equation (1),
β_i = various model parameters, *i*=0 to 1, and
ε = error term.

The basic premise underlying the residual analysis model is that the residuals derived from equation (3.1) represent a "lack of fit" in the match between ERM and the

five firm related variables shown in that equation (Drazin and Van de Ven, 1985; Duncan and Moores, 1989; Gordon and Smith, 1992)[16,17]. Thus, if the basic argument in this paper is correct, the absolute value of the residuals (i.e., lack of fit) in equation (3.1) should be negatively associated with firm performance in equation (3.2).

3.3 Empirical Study

3.3.1 Sample

The sample used for this study was derived from the U.S. Security and Exchange Commission's EDGAR database. The study began with a search for companies that indicated they were utilizing the ERM concept in their 10Ks and 10Qs covering their fiscal year 2005. Following Hoyt et al (2006), firms were initially identified as using the ERM concept is based on a search of the following key terms: enterprise risk management, strategic risk management, corporate risk management, risk management committee, risk committee, and chief risk officer. The sentences that contain the key words were read to get a better sense of whether or not the ERM concept is actually being

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[16] The purpose of this study is to investigate the hypothesis that the match of ERM to firm related factors is significantly related to firm performance and not to provide an explanation of firm performance. The capital asset pricing model assumes that risk is the consistent predictor of (stock market) performance. Accordingly, since we adjust the performance measures for the risk adjusted market return (as discussed in the empirical study in the next section), a full model which explains performance is not necessary.

[17] As an alternative to residual analysis, an interactive specification of the model could be utilized. Such a model would hypothesize that performance is a function of ERM, the additional firm-related factors, and their interaction. Apart from the difficulties in interpreting these results with multiple firm related variables, Drazin and Van de Ven (1985) point out that interactive terms specifically model an acceleration effect on the dependent variable. We believe the residual analysis is a better test of the relationships being considered in this study.

used. Appendix 3.A provides three examples of firm's disclosures about their

implementation of ERM. Those cases where firms are only implementing a partial risk

management approach were eliminated from our sample. For example, in the case of

searching the term "risk committee," terms like "foreign exchange risk committee,"

"operation risk committee," and "financial risk committee" often appeared and these

cases were not considered as applying the full ERM concept. Those cases related to risk

management service providers were also eliminated. Based on this keywords searching

process, 273 firms were identified as having implemented the ERM in 2005. Of these 273

firms, 159 were eliminated due to missing data. Most of the deleted firms are from

banking industry (i.e., with 60 and 61 as the first two digits of SIC codes, according to

the industry classification in Fama and French (1997)).[18] Thus, a final sample of 114 (i.e.,

279-159) firms were used for the empirical analysis is reported in this paper, as listed in

Appendix 3.B. This sample comes from 22 industries, with the utility industry having the

largest percentage (i.e., 35.96 %) of firms (see Table 3.1).

Literature related to the ERM and firm performance only provides empirical

evidence of using a sample from a certain industry. For example, Tufano (1996), by using

a sample of 48 firms in the North American gold mining industry, finds the lack of value

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[18] The construct of ERM index (ERMI) requires the data of Cash Flows from Operating Activities (Compustat #308) in Statement of Cash Flows. In Compustat this data item is not available for banks.

creating from corporate risk management. Mackay and Moeller (2007)'s sample of 34 oil

refiners shows that corporate risk management can add to firm value. Hoyt et al. (2006)

uses 166 U.S. insurers to show ERM's relation to firm value. Although using a sample

from the same industry helps control for regulatory and market variations across

industries, literature casts very few insights on the impacts of industry related contingent

factors (e.g., industry competition) on the relation between ERM and firm performance.

In addition, industry specific evidence in the literature has the common problem of

generalizing the results to other industries. The cross-industry study in Chapter 3 intends

to consider industry related factors as well as providing more generalized evidence to

complement the current literature.

3.3.2 Measurement of Variables

Firm performance: ERM focuses on the risk and return tradeoff. Thus, the excess market

return is one way to measure firm performance because the market returns are risk-

adjusted. (see Kolodny et al, 1989; Gordon and Smith, 1992). More specifically, the

excess market return will reflect the fact that higher performing firms will either have a

higher return for a given level of risk or a lower risk level for a given return level. Thus,

for the study reported in this paper, firm performance is measured by the one-year excess

stock market return to shareholders for 2005, as shown below in equation (3.3). [19] Data to

measure the excess return is obtained from the Compustat.

$$P_i = R_i - [R_f + \beta_i(R_m - R_f)]$$ (3.3)

where, P_i = Performance for firm i,

R_i = Return for firm i,

R_m = Return for the market,

R_f = Risk free rate of return, and

β_i = Beta for the firm i.[20]

Environmental uncertainty (EU): Environmental uncertainty (*EU*) is defined as the

change or variability in the organization's external environment. Following Kren (1992),

environmental uncertainty is measured as the combination of the following three

surrogates metrics: (1) Market - Coefficient of variation of sales (Compustat #12), (2)

Technological -Coefficient of variation of the sum of R&D (Compustat #46) and capital

expenditures (Compustat #128) divided by total assets (Compustat #6), and (3) Income -

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[19] A one year total stock return could be used as an alternative firm performance measure due to the problems of using excess stock market returns (e.g., see Barber and Lyon, 1997; Kothari and Warner, 1997). We also considered this measure of performance. The results from using a one year total stock return are similar to using an excess return as the performance measure and therefore are not reported in this paper.

[20] The return to the market (R_m) is estimated as the one-year return to investors for S&P 500. While this overstates the market return, the overstatement is consistent across firms and provides a more conservative measure of excess performance. The risk free rate (R_f) is calculated as the 5-year U.S. government notes. Betas (β_i) were measured as the 5-year sensitivity of a company's stock price to the overall fluctuation in the S&P 500 Index Price. More specifically, beta is the β_i derived from the following market model: $R_i = \alpha_i + \beta_i R_m + \varepsilon_i$, where R_i is the return on firm i's security; R_m is the S&P 500 Index; β_i is the systematic risk of firm i's security, equals to $COV(R_j, R_m)/VAR(R_m)$; α_i is a constant; and ε_i is the error term (see Sharpe, 1963).

Coefficient of variation of net income before taxes (Compustat #170). For each firm,

providing the data is available for five years, the coefficient of variation is calculated

over the 2000-2005 period based on first differences of all surrogates[21]. The composite

measure of *EU*, and the individual coefficients are computed as shown in equation (3.4)

below.

$$EU = \log\left(\sum_{k=1}^{3} CV(X_k)\right) \qquad\qquad (3.4)$$

where $CV(X_k) = \dfrac{\sqrt{\sum\limits_{t=1}^{5}\dfrac{(z_{k,t} - \overline{z}_k)^2}{5}}}{|\overline{z}_k|}$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$,

$X_{k,t}$ = uncertainty surrogate k in year t,

$k = 1$ to 3 to represent market, technological or income uncertainty, and

$\overline{z}_k$ = mean of changes over 5 years of uncertainty surrogate k.

The absolute value of $\overline{z}_k$ is used as the denominator of $CV(X_k)$ to avoid the case

where a negative $\overline{z}_k$ results into negative $CV(X_k)$ and turns an uncertainty situation into

a certainty situation.

Competition within Industry (CI): Industry competition is measured as one minus

Herfindahl-Hirschman Index (*1- HHI*). The *HHI* represents the sum of squared market

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[21] First differences were used because they provide a better measure of discontinuities, as pointed out by Bourgeois (1985).

shares of all firms in the market. The *HHI* measures the industry concentration and less

concentration means more competition. I define market share as each firm's sales

(Compustat #12) divided by the total sales of the industry. An industry is defined as all

active Compustat firms with the same first two SIC code. The *HHI* is generally

considered to be a better measure of competition intensity than a four-firm concentration

ratio or the number of firms in the market because *HHI* combines information about the

number of firms in a market and their size distribution (Krishnan, 2005b).

Firm complexity (FC): Firm complexity is measured by counting the number of business

segments (from Compustat Segments) for each firm. More business segments will

increase the firm's complexity. For firms with missing data about business segments, I

hand-collect information from 10-K files.

Firm size (FS): Firm size is measured as the natural logarithm of average total assets

(Compustat #6). Market-value is not chosen to measure firm size because firm

performance has been measured using the information about stock prices. This metric for

size is commonly used in accounting studies (e.g., Francis et al. 2004)

Monitoring by Board of Director (MBD): Board monitoring is measured by the number

of directors for each firm divided by the natural logarithm of sales ((number of directors)/

$\log(sales)$). In general, more directors suggest more monitoring power from the board.

However, larger firms usually have more directors than smaller firms. Thus, dividing the

number of directors by the $\log(sales)$ adjusts for this scale effect.[22] Data for this variable

was hand collected from the 2005 10-K files of firms. I also investigated the number of

board meetings in a year as an alternative measure for board monitoring and results from

using this alternative measure are provided as a robustness check in Section 3.5.

ERM Index (ERMI): Discussions of ERM are generally devoid of any specifics on how to

quantitatively measure the concept. Accordingly, we developed an ERM Index (*ERMI*)

for measuring the effectiveness of ERM used in equation (3.1). The Index is based on

COSO's four objectives. In other words, we developed an index of the effectiveness of an

organization's ERM based on its ability to achieve its objectives relative to strategy,

operations, reporting, and compliance. The basic goal of the *ERMI* is to sum up the

achievement of the above four objectives. Two indicators are used for measuring the

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[22] Sales, instead of the firm's assets, are chosen for this scale effect because assets have been used for measuring the firm size.

achievement of each objective. *ERMI* is then constructed by summing up all eight

indicators for the above four objectives, as equation (3.5) shows.

$$ERMI = \sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k \qquad (3.5)$$

Each indicator is standardized among the sample of 114 ERM firms before being

combined in equation (3.5). The definition and related data for each indicator is explained

below. Whenever the industry is mentioned, the industry is measured as all active firms

with the same two digits SIC code in Compustat.

Strategy: Strategy refers to the way a firm positions itself in the market place relative to

its competition. In executing its strategy, a firm tries to develop a competitive advantage

over competitors in the same industry. All firms in the same industry compete for the

limited sales opportunities in the same market. Thus, more sales by firm *i* relative to the

industry average sales means that firm *i* is outperforming its average competitors. Hence

a measure of whether or not a firm had a success of strategy is the number of standard

deviations its sales (Compustat #12) deviates from the industry sales, as shown below.

$$Strategy_1 = \frac{Sales_i - \mu_{Sales}}{\sigma_{Sales}}$$

where $Sales_i$ = Sales of firm *i* in 2005,

μ_{Sales} = average industry sales in 2005, and

σ_{Sales} = standard deviation of sales of all firms in the same industry.

The second measure for strategic success is a firm's competitive advantage within

industry in reducing systematic risks. One major benefit of implementing ERM is to

diversify away risks by managing a portfolio of risks arising from all sources (Cummins,

1976; Hoyt and Liebenberg, 2006; Nocco and Stulz, 2006; Schramm and Sherman, 1974;

and Tufano, 1996). ERM can therefore be deemed as firms applying diversification

strategy on managing risks. Thompson (1984) measures the performance of

diversification strategy by the reduction in systematic risk, or beta. The rationale behind

this measure is that the systematic risk from market model describes a firm's

undiversified risk, and a more successful diversification strategy can diversify more risks

to reduce undiversified risk by managing firm's risk portfolio. The second measure of

strategic success is therefore a firm's reduction in beta risks, relative to the other firms in

the same industry.

$$Strategy_2 = \frac{\Delta\beta_i - \mu_{\Delta\beta}}{\sigma_{\Delta\beta}}$$

where $\Delta\beta_i = - (\beta_i$ in 2005 - β_i in 2004),
β_i = firm i 's beta (data from Compustat).
$\mu_{\Delta\beta}$ = average industry $\Delta\beta$ in 2005, and
$\sigma_{\Delta\beta}$ = standard deviation of $\Delta\beta$'s of all firms in the same industry.

Operating Efficiency: Operating efficiency (or operating productivity) can be measured

as the input-output relationship in the process of a firm's operation (Banker et al, 1989).

More output for a given level of input or less input for a given level of output means

better operating efficiency. Thus, the turnover of assets, defined as sales (Compustat #12)

over total assets (Compustat #6), is one measure for operating efficiency (Kiymaz, 2006),

as shown below.

$$Operation_1 = (Sales)/(Total\ Assets)$$

Another measure of operating effectiveness is to define the input-output

efficiency from operations by dividing sales (Compustat #12) by number of employees

(Compustat #29), as shown below.

$$Operation_2 = Sales/\ (Number\ of\ Employees)$$

Reporting Reliability:[23] Illegal earnings management, financial restatements, and

financial fraud all inhibit the attainment of reliable financial reports. In fact, these

practices have been used as evidence of poor financial reporting (Cohen et al, 2004).

Thus, one measure for low reporting reliability is the combination of the following three

readily observed variables: *Material Weakness*, *Auditor Opinion*, and *Restatement*. Firms

are mandated to disclose any material weakness of internal control in financial reporting

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[23] FASB's SFAC No. 2 paragraph 59 states "the reliability of a measure rests on the faithfulness with which it represents what it purports to represents, coupled with an assurance for the user, which comes through verification, that it has representational quality". Reporting reliability covers only the representational dimension of the reporting quality. Our ERMI focuses on the reliability of financial reporting following COSO ERM's definition of reporting objectives.

following the requirement of Sarbanes-Oxley Act of 2002. If a firm discloses any

material weakness in its annual report, the variable *Material Weakness* is set to -1,

otherwise is set to 0. Auditors express their opinion about a firm's financial reporting in

their auditors' report. Firms with unqualified opinions in their auditor's report have the

variable *Auditor Opinion* set equal to 0, otherwise it is set to -1. The data about *Material

Weakness* and *Auditor Opinion* is hand collected from 2005 annual reports in EDGAR

database. The restatement of a firm's financial statements is viewed as a reduction of a

firm's reporting reliability. The GAO (2006) provides a database containing a firms'

announcements of financial restatements. If a firm announced a restatement in 2005, the

variable *Restatement* is set to -1, otherwise it is set to 0. The range for *Reporting$_1$* is

therefore from -3 to 0.

$$Reporting_1 = (Material\ Weakness) + (Auditor\ Opinion) + (Restatement)$$

The absolute value of abnormal accruals has also been used to measure poor

financial reporting quality (Johnson et al, 2002).[24] Thus, a second measure of a firm's

reporting Reliability used in this study reported in this paper is the relative proportion of

the absolute value of normal accruals divided by the sum of the absolute value of normal

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[24] Johnson et al (2002) page 644 discusses the use of absolute value depends on whether there is a priori expectation regarding the direction of managerial incentives. The measurement of reporting reliability in this study is not related to directional management incentives. Therefore the absolute value is used.

and abnormal accruals.[25] Absolute values are used because both normal accruals and

abnormal accruals could be negative and their relative strength could be better measured

by using their absolute values.

The abnormal accruals are estimated using the cross-sectional Jones (1991) accruals

estimation model, as described in DeFond and Jiambalvo (1994) and Defond and

Subramanyam (1997). In this model normal accruals are estimated as a function of the

change in revenue (Compustat #12) and the level of property, plant and equipment

(Compustat #8). These variables control for changes in accruals that are due to changes in

the firm's economic condition. Total assets (Compustat #6) at the beginning of the year

are used as the deflator for all variables in the model. The abnormal accruals are

estimated from equation (3.6) below.

$$TA_{ijt} / A_{ijt-1} = \alpha_{jt}[1/A_{ijt-1}] + \beta_{1jt}[\Delta REV_{ijt} / A_{ijt-1}] + \beta_{2jt}[PPE_{ijt} / A_{ijt-1}] + e_{ijt} \qquad (3.6)$$

where t = year 2005,
$\quad TA_{ijt}$ = total accruals for firm i in industry j,
$\quad A_{ijt-1}$ = total assets for firm i in industry j,
$\quad \Delta REV_{ijt}$ = change in net revenues for firm i in industry j,
$\quad PPE_{ijt}$ = gross property plant and equipment for firm i in industry j, and
$\quad e_{ijt}$ = error term for firm i in industry j.

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[25] As summarized by Johnson et al (2002) that, in the literature, the focus is usually on abnormal accruals, which measures how poor is the reporting reliability. Thus the common measure is $|AbnormalAccruals|/(|NormalAccruals| + |AbnormalAccruals|)$. This study intends to measure how good is the reporting reliability. Therefore, we place the normal accruals in the nominator of our measure $|NormalAccruals|/(|NormalAccruals| + |AbnormalAccruals|)$.

Total accruals are defined as income before extraordinary items (Compustat #18)

minus operating cash flows (Compustat #308). Industry-specific estimates are obtained

from the coefficients from the ordinary least squares of equation (3.6). The variable for

abnormal accruals (i.e., *AbnormalAccruals*) is the error term from the regression model

shown in equation (3.6). The variable normal accruals (i.e., *NormalAccruals*) is defined

as Total accruals minus *AbnormalAccruals*). *Reporting$_2$* is then measured as the

following:

$$Reporting_2 = \frac{|NormalAccruals|}{|NormalAccruals| + |AbnormalAccruals|}$$

Compliance Effort: O'keefe et al (1994) found compliance with Generally Accepted

Auditing Standard (GAAS) increases with audit fees. Thus, the first measure of

compliance effort used in the study reported in this paper is the proportion of auditor's

fees to net sales revenue (Compustat #12). Auditor's fees are paid mainly for the services

derived from auditing financial statements, certification, examining individual and

consolidated accounts, due-diligence reviews, agreed-upon procedures (e.g., confirming

compliance with specific contractual agreements), and tax compliance and consultancy.

The data for auditor's fees (*AuditorFees*) are collected from proxy statements and scaled

by total assets (Compustat #6).

$$Compliance_1 = \frac{Auditor\ Fees}{Total\ Assets}$$

If firms put more effort into regulation compliance, it seems reasonable to expect that they will have less settlement losses and more settlement gains. Thus, the second measure of compliance effort used in the study reported upon in this paper is settlement gain (loss) (Compustat #372)[26] over total assets (Compustat #6).

$$Compliance_2 = \frac{Settlement\ Net\ Gain}{Total\ Assets}$$

The definition for *ERMI* is summarized in Appendix 3.D.

3.3.3 Testing Method

The discussion about the importance of contingency variables to ERM in Section II of this paper indicates that the enterprise risk management index (*ERMI*) is contingent on the proper match between environmental uncertainty, industry competition, firm size, firm complexity, and board monitoring. Following Gordon and Smith (1992) we derive the functional relation between the *ERMI* index calculated from equation (3.5) and these five contingency factors for the high performing firms, where high performing firms are defined as those with an excess return greater than 2%.[27] The coefficients for the five

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[26] Compustat #372 is the sum of all settlement special items reported before taxes, including: 1) provisions to boost reserves for litigation and settlements, 2) insurance recovery and proceeds, and 3) reversal of reserve for litigation and settlements. Net settlement income (gains) is positive and net settlement expense (losses) is negative. This data item excludes settlements relating to pension plans.

[27] We also try other cut-offs of excess returns for the high performing firms. This sensitivity test is shown in our robustness check in Section V.

contingency factors are derived based on the high performing firms. In essence, the high

performing firms are used as the benchmark group, such that the relation between ERM

and the five contingency variables derived from these firms is viewed as an "ideal" or

"best practice" ERM-contingency model. Equation (3.7) is used to estimate this relation

for high performing firms.

$$ERMI_i = \beta_0 + \beta_1 EU_i + \beta_2 CI_i + \beta_3 FC_i + \beta_4 FS_i + \beta_5 MBD_i + \varepsilon_i \qquad (3.7)$$

The coefficients derive from the high performing group represent the proposed

"best practice" model, as in equation (3.8).

$$\widehat{ERMI_i} = \widehat{\beta_0} + \widehat{\beta_1} EU_i + \widehat{\beta_2} CI_i + \widehat{\beta_3} FC_i + \widehat{\beta_4} FS_i + \widehat{\beta_5} MBD_i \qquad (3.8)$$

Instead of focusing on individual contingency variable, this proposed "best

practice" model emphasizes the holistic perspective concerning the way all contingencies

variables are related to ERM. Firms following this "best practice" model will presumably

show higher performance than those that follow a different model.

To test the basic argument, residual analysis is used. Residual analysis has the

advantage of using the holistic concept of fit by simultaneously including internal

controls, contextual variables, and firm performance (Duncan and Moores, 1989). For all

firms, the absolute value of the residuals (*ARES*) is calculated by applying the derived

coefficients from high performing firms in equation (3.8). The *ARES* variable measures

the deviation from the proposed best fit determined by high performing firms. That is,

$$ARES_i = \left| ERMI_i - \widehat{ERMI_i} \right| \tag{3.9}$$

The relationship between *ARES* and firm performance can then be tested by the

following model.

$$P_i = \beta_0 + \beta_1 ARES_i + \varepsilon_i \tag{3.10}$$

In equation (3.10), *ARES* is expected to be negatively related to the firm

performance (i.e. β_1 in equation (3.10) is expected to be negative). The reason for this

expectation is that *ARES* measures the deviation from the "best practice" (or best fit) in

terms of matching from the firm's ERM and the contingency variables (e.g., see Drazin

and Van de Ven, 1985).

3.4. Empirical Results

3.4.1 Summary Statistics and Univariate Test

I selected high performing firms as those firms with a one year excess return

greater than 2%, following Gordon and Smith (1992). Summary statistics for the total

sample, high performing firms, and the other firms are provided in Table 3.2. Based on

the cutoff of 2% one year excess return, there are 54 high performing firms in our sample.

The average *ERMI* for the high performing group is -0.073, as compared to 0.066 for the remaining firms. However, these two groups are not statistically different in their means of *ERMI* (test of difference in means shows p-value 0.776). In addition, all five contingency variables of the high performing group of firms and the other firms are not statistically different in means. These results from univariate test indicate that *ERMI* and the five contingency variables, by themselves, do not account for high performance.

Table 3.3 provides the Spearman and Pearson correlation analysis for all 114 firms. Among the dependent variables in regression model (3.7) (i.e., *EU*, *CI*, *FC*, *FS*, and *MBD*), *MBD* is highly correlated with *EU* (Pearson correlation coefficient 0.219 with p-value 0.019) and *FS* (Pearson correlation coefficient –0.454 with p-value <0.001). These strong correlations suggest the possibility of multicollinearity in estimating model (3.7). Given this potential multicollinearity problem suggested by our correlation analysis, we will check the Variance Inflation Factor (or VIF) and Tolerance along with our analysis of model (3.7).[28]

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[28] The Tolerance is the proportion of variance in a given predictor that is not explained by all of the other predictors, while the VIF is simply 1 / tolerance. The VIF represents a factor by which the variance of the estimated coefficient is multiplied due to the multicollinearity in the model. Values of VIF exceeding 10 and Tolerance less than 0.1 are often regarded as indicating multicollinearity (Ayyangar, 2007, page 5)

3.4.2 Main Results

Results from regression model (3.7) for the total sample and each group are shown in Panel A in Table 3.4. For the group of high performing firms, four of the contingency variables (i.e., industry competition, firm complexity, firm size and board monitoring) have a significant effect on the effectiveness of ERM. The one exception is for environmental uncertainty. Conversely, for the other firms (i.e., the firms which are not the high performers), none of the contingency variable shows significant effect on ERM. Since contextual factors are usually exogenous variables, this result suggests high performing firms are taking contingency variables more seriously than the other firms in their implementation of ERM. The other finding from Table 3.4 Panel A is that, for all regressors, VIFs are very low and Tolerances are very high, indicating no concern about the problem of multicollinearity in our regression analysis.

In Table 3.4, the coefficients derived from the group of high performing firms will be the proposed proper match between ERM and the contingency variables. In other words, all coefficients in equation (3.8) should be replaced by the coefficients from high performing group in Table 3.4, as the following equation.

$$\widehat{ERMI}_i = 20.626 - 0.217\ EU_i - 12.707\ CI_i - 2.283\ FC_i - 0.372\ FS_i - 2.977\ MBD_i \qquad (3.11)$$

According to the basic argument, if all firms choose the ideal match between their ERM and the contingency variables based on the specification in equation (3.11), they will have a greater chance of having high performance. In order to test this hypothesis, I need to test whether more deviation of a firm's *ERMI* from $\widehat{ERMI}$ will result in lower firm performance. Firm performance is then regressed on $ARES_i = \left| ERMI_i - \widehat{ERMI_i} \right|$ for all firms, as shown in regression equation (3.10). The results of this residual analysis are shown in Table 3.4 Panel B.

As hypothesized, the coefficient of *ARES* (-3.221) is significantly negative at the significant level of 0.05 (see Table 3.5). In other words, a greater deviation from the proposed match will result in a larger *ARES*, and *ARES* is negatively associated with firm performance. Thus, the results in Table 3.4 Panel B support the main hypothesis that the proper match between ERM and the contingency variables is a key driver of firm performance. The importance of this proper match for firm performance is strengthened if we recall the results in Table 3.2, where neither the *ERMI* nor the contingency variables by themselves show a significant difference between the high performing group of firms and the other firms.

3.5. Robustness Checks

3.5.1 Propensity Matched Sample

The propensity matched sample is created for two robustness checks. First, firms

might choose to implement ERM or disclose ERM (Hoyt and Liebenberg, 2006). Some

of the factors that are correlated with firm's choice to adopt ERM may also be correlated

with the observed effectiveness of ERM (i.e., the variable *ERMI*) and firm performance

(i.e., the variable *P*). With the propensity matched sample, I can check whether our

results in main analysis are robust to adding 114 non-ERM firms with the same

propensity of adopting ERM. I can also control for this self-selection choice by including

to our model (3.7) one more indicating variable about whether a firm is implementing

ERM sample. In other words, I control for firm's self-selection of ERM in developing our

proposed proper match between ERM and contingency variables, which supplies the

residual analysis with the residuals (and *ARES*) that have been corrected for the self-

selection problem.

Second, I can use the propensity matched sample to check whether our *ERMI*,

defined as the extent of achieving the four objectives in COSO ERM (2004), is a valid

measure for the effectiveness of firm's ERM. If ERM firms' main pursuit is the four

objectives in COSO ERM (2004) and our construct of *ERMI* in equation (5) properly

measures the achievement of those objectives, after controlling for the propensity of adopting ERM, ERM sample should be expected to have higher *ERMI* than non-ERM control sample.

The propensity matched sample is created by matching our 114 ERM firms with 114 non-ERM same-industry firms having the closest propensity scores of implementing ERM.[29] The propensity scores are the predicted probabilities from the following probit regression that estimates the likelihood of adopting ERM.

$$Prob(ERM_i = 1) = \beta_0 + \beta_1 Big4_i + \beta_2 FS_i + \beta_3 ZScore_i + \beta_4 DE\ Ratio_i$$
$$+ \beta_5 Investment\ Opportunity_i + \beta_6 Foreign\ Transaction_i + \varepsilon_i \quad (3.12)$$

The variables in (3.12) are explained as follows. We use a dummy variable ERM_i to indicate whether firm *i* engages in ERM ($ERM_i = 1$) or did not engage in ERM ($ERM_i = 1$) at any point during 2005. I select the six determinants in probit regression by consulting the literature related to the determinants of ERM (Beasley et al. 2005; Dionne and Triki, 2003; Hoyt and Liebenbert, 2006; and Liebenberg and Hoyt, 2003). $Big4_i$ is a dummy variable and is set to one if firm *i*'s auditor is from big four CPA firms, or set to zero otherwise. FS_i stands for firm size and is measured as the logarithm of firm *i*'s total assets (Compustat #6). $ZScore_i$ is the Z-score developed by Altman (1968) to proxy for firm *i*'s financial distress. $DE\ Ratio_i$ is to divide total debt (Compustat #9 +

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[29] Same industry firms are firms with the same first two digits SIC codes.

Compustat#34) by stockholder's equity (Compustat #216) to measure firm i's financial

leverage. *Investment Opportunity*$_i$ is to proxy for firm i's investment opportunities by

the sum of capital expenditure (Compustat #128) and R&D expenditures (Compustat #46)

scaled by firm's total assets. *Foreign Transaction*$_i$ in an international diversification

dummy takes on a value of one if firm i has none zero foreign currency adjustment

(Compustat #150) in 2005, and zero otherwise. β_0 through β_6 are estimation coefficients.

ε_i is the error term. Data for all six determinants in (3.12) are from Compustat.

We estimate the probit regression model (3.12) using 244 ERM firms and 7,232

firms in the Compustat with available data and never disclosing any ERM in their 2005

filings. The results are presented in Appendix 3.C. The propensity scores, or the predicted

probabilities from the above probit model, are then used to match our 114 ERM sample

with non-ERM firms in the same industry with the closest propensity scores. This method,

known as propensity score matching (LaLonde, 1986), creates a non-ERM control

sample of 114 firms with the same predicted probabilities of adopting ERM.

Table 3.5 Panel A shows the univariate test for the difference between the ERM

and none-ERM firms. None of performance (*P*), *ERMI*, and five contingency variables

show significant difference between the two groups. Notably, the mean of *ERMI* for

ERM group (0.271) is higher than that for none-ERM group (-0.271), but their difference

(0.541) is only close to the significant level (p-value=0.124). Basic evidence from univariate test suggests our *ERMI* might be a fair yet not perfect index for measuring the effectiveness of ERM.

In order to control for firm's self-selection of ERM, I use the 112 high performing firms of 228 propensity matched firms (i.e., 114 ERM firms and 114 non-ERM firms) to develop the proposed proper match, where the high performing firm is defined the same as in our main analysis in Section IV. I also modify our model (3.7) by adding one more control variable ERM_i, as the following equation shows.

$$ERMI_i = \beta_0 + \beta_1 EU_i + \beta_2 CI_i + \beta_3 FC_i + \beta_4 FS_i + \beta_5 MBD_i + \beta_5 ERM_i + \varepsilon_i \qquad (3.13)$$

The results for (3.13) are shown in Table 3.5 Panel B. Some coefficients of the contingency variables are not as significant as in our main analysis in Section 3.4. This weakened result could be because we include non-ERM firms into our analysis, and non-ERM firms in fact neither implement ERM nor consider contingency variables for ERM. However, we want to analyze the coefficients of ERM_i to check the validity of our *ERMI* construct. The coefficients of ERM_i are consistently positive: 0.591, 0.324, and 0.7 for total sample, high performing firms, and the other firms, respectively. Only the coefficient of ERM_i for the total sample is significant at 10% level (p-value 0.09). This

result confirms the evidence from our univariate test that our *ERMI* is a fair, yet not perfect, measure for the effectiveness of ERM.

The coefficients for high performing group in Table 3.5, Panel B represent the proposed proper match between ERM and contingency variables and are used for residual analysis, as shown in Table 3.5 Panel C. The coefficient of *ARES* is significantly negative, suggesting that deviations from the proposed proper match are negatively related to firm performance. Therefore, after correcting the self-selection bias, the empirical evidence still supports our basic argument that the relation between ERM and firm performance is contingent on the proper match between ERM and contingency variables.

3.5.2 Different Cutoffs for High Performing Firms

The main analysis in this study picks up the cutoff of 2% one year excess return for high performing firms to follow the literature (Gordon and Smith, 1992). I also tried different cutoffs for high performing firms to address the concern that our main analysis might be sensitive to the change of the cutoffs for high performing firms. Specifically, I used the cutoffs from 0% to 10% one year excess return. The lowest cutoff checked is 0% one-year excess return because, intuitively, we do not define firms with a negative excess return as having high performance. The highest cutoff tested is 10% one year excess

return because, beyond 10%, the number of high-performing firms will be reduced to less

than 33 and will result in a low power of test.

Table 3.6 shows the results under the different cutoffs of high performing firms.

Besides *EU*, the coefficients for the other four contingency variables are always

significant although this significance is decreasing as we increase the percentage of

cutoffs. However, the residual analysis consistently shows negative coefficients for *ARES*,

with significance levels between p-values 0.021 and 0.039. This robustness check shows

that the results in the main analysis in Section 3.4 are not sensitive to the changes of the

cutoffs for high performing firms

3.5.3 Alternative Measure for the Monitoring by Board of Directors

In the main analysis in Section 3.4, I measure the monitoring by board of directors

(i.e., the contingency variable MBD_i) as the number of directors. However, Vafeas (1999)

uses the frequency of board meetings to measure the monitoring from the board and has

shown significant impact on firm performance. Therefore, I also used the number of

board meetings in 2005 as an alternative measure for the monitoring by the board. The

data for the number of board meetings is obtained from Compustat Executive

Compensation.

As in Table 3.7 Panel A, the number of ERM firms is greatly reduced when I use the alternative measure for MBD_i because Compustat Executive Compensation only contains data for around 2,500 firms. There are only 30 high performing firms available for developing the proposed proper match. Notwithstanding the reduction in sample size, Table 3.7 Panel B still shows significant and negative coefficient of *ARES* (coefficient -7.019 and p-value 0.005), supporting the basic argument that the relation between ERM and firm performance is contingent on the proper match between ERM and contingent variables.

3.5.4 Alternative Timing of Excess Returns

One concern regarding our main analysis is the use of one year excess returns based on the end of 2005. This concern stems from the fact that annual reports and related financial information are not usually available to the market until three months after the end of the year. To address this concern, I changed the timing of one year excess returns to three months after the end of the year.[30] Based on this new timing of excess returns, the high performing group of firms (i.e., those with an excess return greater than 2%) now includes 70 firms.

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[30] A one year return ending three months after the end of year was also considered. The results are very similar to the results using a one-year excess return and are therefore not reported.

The results from regressing the *ERMI* on the contingency variables are shown in Table 3.8, Panel B. All five contingency variables for high performing firms have lower p-values than the other group of firms, suggesting that high performing firms are more concerned with the proper match between their ERM and contingency variables than the other groups of firms.

From Table 3.8, Panel A, the proposed proper match derived from the high performing group of firms is now derived from the following equation (3.14).

$$\widehat{ERMI_i} = 18.819 - 0.204 \, EU_i - 11.845 \, CI_i - 0.551 \, FC_i - 0.282 \, FS_i - 3.518 \, MBD_i \qquad (3.14)$$

Equation (3.14) is then applied to all 114 firms in the sample for the residual analysis and the results can be found in Table 3.8, Panel B.

The coefficient of the *ARES* shown in Table 3.8, Panel B, is significantly negative at a level of 0.05. This result is consistent with the main analysis (see Table 3.4) about the existence of the proper match. That is, a greater deviation from the proposed match between ERM and the contingency variables (Model (3.14)) is associated with lower firm performance.

3.6 Concluding Comments

Using a sample of 114 firms disclosing the implementation of enterprise risk management (ERM) in their 2005 annual reports, the study in Chapter 3 reports on an empirical study that investigates whether the relation between ERM and firm performance is contingent upon the proper match between the ERM and five key contingency variables. The findings from this study confirm the argument that the ERM-firm performance relation is indeed contingent on the proper match between ERM and the following five variables: environmental uncertainty, industry competition, firm size, firm complexity, and monitoring by the board of directors. This finding is robust, even when I correct for the self-selection bias, choose different cutoffs of high performing firms, use alternative measure for board monitoring, and consider an alternative timing for firm performance.

The intuitive and obvious findings in our analysis suggests that our ERM Index (*ERMI*), constructed from some general indicators based on COSO's concept of ERM (2004), are in the right direction to measure the effectiveness of ERM. By using a propensity matched sample, the validity of our *ERMI* is also found to be a fair, although not perfect, measure for the effectiveness of ERM.

As with most empirical studies in the social sciences, there are limitations to this study. Thus, since this is the first study of its kind (at least to our knowledge), the findings should be interpreted as preliminary rather than definitive. The limitations to this study include the following. This study only covers year 2005. Therefore the findings in this study might be hard to be generalized to other time periods. Another limitation of this study relates to that fact that I use a one-year excess return to measure firm performance. Other measures of performance (e.g., Tobin's Q or a five-year excess returns) could also be considered.

The above limitations notwithstanding, I believe that the results of the study reported in this paper provide important insight into the relation between ERM and firm performance. In essence, these results show that the net benefits that firms will derive from implementing an ERM system are contingent on key variables surrounding the firms.

Chapter 4 Summary and Discussion

This dissertation investigates two research questions arising from SOX's regulatory requirements on internal controls.

As presented in Chapter 2, with respect to the research question about the relation between internal controls and firm performance, I use the residual income model as the market valuation model to examine the relation between market-value and firms with weak internal controls. The findings show that weak internal controls have lower market-value. Firms with weak internal controls are identified as firm-years that disclose material weaknesses in internal control in annual reports from August 2002 to March 2006. The negative relation between week internal control and market-value is robust to the control for a 10K-only material weakness sample. This result is also robust to the correction for self-selection bias, using both the inverse Mills ratio approach and propensity score matching. In order to further explore the relation between internal control and firm performance, I also test and find that the negative relation between market-value and internal control deficiencies is stronger when the internal control problems are related to more-than-reporting internal controls (MTRICs), than reporting-only internal controls

(FRICs). Based on the above findings, I answer the first research question by concluding that better internal control implies better firm performance. These findings provide support for the SOX's efforts to promote better internal controls. Another insight from this study is that firm value can be further created if firms do not limit their design and implementation of internal controls to the objective of reporting reliability.

The study in Chapter 3 addresses the second research question regarding the contingency view on ERM and firm performance. This chapter addresses the question concerning the proper match between ERM and contingency variables. Using a sample of 114 firms disclosing the implementation of ERM in their 2005 10Ks and 10Qs, the empirical study investigates whether the relation between ERM and firm performance is contingent on the proper match between ERM and five key contingency variables: environment uncertainty, industry competition, firm size, firm complexity, and monitoring by the firm's board of directors. High performing firms are defined as those with greater than 2% one year excess return and are used to form the proposed proper match. An ERM index (ERMI) is constructed based on COSO ERM's (2004) definition of four objectives: strategy, operation, reporting, and compliance. The contingency view is supported by the empirical evidence, since the deviation from the proposed proper match is found to be negatively related to firm performance. This finding is robust to

checks for the correction of self-selection bias, different cutoffs for the definition of high

performing firms, alternative measure for board monitoring, and alternative timing to

measure firm performance. The empirical findings provided in Chapter 3 support the

contingency argument concerning the relation between firm performance and ERM. Thus,

firms that pursue business success building on all the compliance efforts for SOX are

advised to refer to the proper match (or sometimes called the "best practice") between

their implementation of ERM and environmental factors.

 Based on this dissertation, at least two extensions might be possible for future research.

First, future study might want to explore whether the implementation of ERM enhances

firm's internal controls. One of the motivations for this dissertation is that sound internal

control system rests on the analysis and management of enterprise-wide risks. Although

the empirical evidence in this dissertation shows that both internal control and ERM are

related to firm performance, the relation between internal control and ERM remains

unclear and should be further investigated. Second, as an extension from the research in

Chapter 2, future study may explore the relation between internal control and firm

performance by comparing one firm's performance before and after the disclosure of

material weaknesses in internal control, instead of comparing material-weaknesses and

non-material-weaknesses firms as the current study in Chapter 2.

Appendix 2.A Classification of FRIC and MTRIC Related Material Weaknesses

Material Weaknesses in Reporting-Only Internal Controls (FRICs)
- Account and transaction specific financial reporting weaknesses
- Weaknesses in financial reporting procedures
- Financial reporting specific personnel weaknesses

Material Weaknesses in More-Than-Reporing Internal Controls (MTRICs)
- Override by senior management
- Control environment weaknesses
- Lack of competent staff
- Lack of training for personnel
- Control system or IT system weaknesses
- Weaknesses in Compliance with Tax Laws

Examples of Material Weaknesses in Reporting-Only Internal Controls

AMCON Distributing Corp.

The Company's Chief Executive Officer and Chief Financial Officer concluded that a material weakness existed in the Company's disclosure controls and procedures with respect to the application of accounting guidance contained in certain Emerging Issues Task Force Applications ("EITF's") and other accounting standards relating to the Company's recent financing transactions.

General Electric Corp.

We identified the following material weakness in our internal control over financial reporting with respect to accounting for hedge transactions: a failure to ensure the correct application of SFAS 133 when certain derivative transactions were entered into at GECC prior to August 2003 and failure to correct that error subsequently.

Examples of Material Weaknesses in More-Than-Reporing Internal Controls

Hollinger International Inc.

The Company's management concluded that the following material weaknesses in the Company's internal control and ineffectiveness in the design and operation of the Company's disclosure controls and procedures, among others, existed during the year ended or as of December 31, 2003:

• The "tone from the top" established by the former executive officers was inappropriate to the establishment of an environment in which strong systems of internal control and disclosure controls and procedures are encouraged.

• Certain former executive officers of the Company, who were also executive officers at the Company's various controlling stockholders, did not participate in open and timely

communication with those responsible for the preparation of corporate reports or with the Board of Directors, in particular its independent members.

• The management and corporate organizational structures facilitated extraction of assets from the Company by way of related party transactions to benefit direct and indirect controlling stockholders.

• Common directorships, among certain former executive officers, at the Company and its direct and indirect parent companies and their affiliates, facilitated inappropriate related party transactions between the Company and those entities.

• The management and reporting structures fostered and maintained the perception of Ravelston and its direct and indirect subsidiaries being one consolidated corporate group, thus blurring the distinction between the interests of individual entities and their respective unaffiliated stockholders.

Leapfrog Enterprises Inc.

In the area of information technology controls, we identified the following insufficient controls which we believe constitute a material weakness in the aggregate.

• Ineffective logical access and change management controls related to information technology systems, data and programs that are used to monitor, record and transfer information. These controls relate to the purchase of materials and components used to manufacture and assemble our products, the manufacture and assembly of our products, the distribution, invoicing and sale of our products and the remittance of payments by our vendors, our customers and ourselves related to these activities.

• Pervasive inadequacies in enterprise resource planning, or ERP, application controls related to appropriate assignment of functions and segregation of duties, which allowed employees to access system programs and data or initiate transactions inconsistent with their assigned duties. Our ERP systems contain design deficiencies that do not adequately segregate and control access, and lack sufficient human oversight over the assignment of system access and authorities.

• Lack of appropriate training of personnel throughout the organization causing system users to be less effective due to insufficient understanding of the systems they manage and depend upon.

Appendix 2.B First Stage Estimation of Heckman Two-Stage Selection Analysis

	Dependent Variable				
	MW	MW_t	$Occur_t$	$Amend_t$	VD_t
	All MW firms	10K-only MW firms	10K-only MW firms	10K-only MW firms	All MW Firms
Independent Variables	Coeff Est $(pr> \chi^2)$	Coeff Est $(pr> \chi^2)$	Coeff Est $(pr> \chi^2)$	Coeff Est $(pr> \chi^2)$	Coeff Est $(pr> \chi^2)$
Intercept	-1.769	-1.844	1.507	1.208	0.949
	(<0.001)	(<0.001)	(<0.001)	(0.001)	(<0.001)
TA	-0.000	-0.000	0.033	-0.059	0.009
	(0.600)	(0.448)	(0.481)	(0.065)	(0.766)
AGGREGATE	0.2748	0.295	-0.114	0.238	-0.282
LOSS	(<0.001)	(<0.001)	(0.510)	(0.063)	(0.016)
FOREIGN	0.135	0.156	-0.368	0.182	0.143
TRANSACTIONS	(<0.001)	(<0.001)	(0.031)	(0.191)	(0.267)
SALES GROWTH	0.001	0.001	0.103	0.168	-0.061
	(0.213)	(0.218)	(0.579)	(0.282)	(0.460)
RESTRUCTURING	-0.854	-0.545	-2.145	7.255	-0.220
CHARGE	(0.366)	(0.563)	(0.668)	(0.138)	(0.954)
Number of Obs with the dependent variable set to one	708	594	38	106	131
Number of Total Obs	13,934	13,800	594	700	708
Likelihood Ratio Score $(Pr > \chi^2)$	96.867 (<0.001)	106.820 (<0.001)	7.123 (0.212)	16.839 (0.005)	8.487 (0.131)

MW_t is an indicator variable that is equal to one if the firm disclosed a material weakness in 10K, 10KSB, or amendment of annual report in year *t* in our sample period (August 2002 to March 2006), and zero otherwise. $Occur_t$ is an indicator variable that is equal to one for a disclosure of material weakness in 10K if the firm has prior history of disclosing material weaknesses in annual repots through out our sample period (August 2002 to March 2006), and zero otherwise. $Amend_t$ is set to one if the firm disclosed material weakness in 10K amendment in year *t* through out our sample period (August 2002 to March 2006), and zero otherwise. VD_t is set to one if a voluntary disclosure, or to zero otherwise. *TA* is firm's total asset [Compustat #6] in year t. *AGGREGATE LOSS* is an indicator variable equal to one if earnings before extraordinary items [Compustat #18] in years t and t-1 sum to less than zero, and zero otherwise. *FOREIGN TRANSACTIONS* is an indicator variable equal to one if the firm has a non-zero currency transaction [Compustat #150] in year t and zero otherwise. *SALES GROWTH* is sales [Compustat #12] in year t minus the sales in year t-1 and then divided by sales in year t-1. *RESTRUCTURING CHARGE* is the restructuring charge [Compustat #376 * (-1)] in year t scaled by firm's asset [Compustat #6]

Appendix 2.C Classification of Material Weaknesses According to Five Components of Internal Control in COSO(1992)

Control Environment Weaknesses

Weaknesses related to the integrity, ethical values and competence of entity's people, management's philosophy and operating style, the way management assigns authority and responsibility, organizes and develops its people, and the attention and direction provided by the board of directors

Risk Assessment Weaknesses

Weaknesses related to the identification and analysis of relevant risks to achieve the objectives which form the basis to determine how risks should be managed.

Control Activities Weaknesses

Weaknesses related to activities like approvals, authorizations, verifications, reconciliations, reviews of operating performance, security of assets and segregation of duties.

Information and Communication Weaknesses

Weaknesses related to the identification, capturing, and communicating information to the right people to enable them to carry out their responsibilities. Weaknesses related to preparing a timely and accurate financial report.

Monitoring Weaknesses

Weaknesses related to the management activities and supervisory activities.

Example: Weakness related to Control Activities and Information and Communication
Harleysville National Corp.
The following material weakness has been identified and included in management's assessment. There were ineffective controls over employee access to the computer system which were identified in the areas of general ledger, deposits, loans, customer information files, and the Bank's Automated Clearing House. The purpose of these controls is to ensure proper segregation of duties within the identified functional areas.

Example: Weakness related to Control Environment and Monitoring
Active Power Inc.
As a part of our assessment as of December 31, 2004, we considered both the composition and the limited size of our accounting department and their effect on the design of the controls established over our financial reporting process. In December 2004 our Chief Financial Officer announced his resignation to pursue another opportunity, but

agreed to continue to serve as our Chief Financial Officer on a transitional basis through the completion of certain financial reporting events, including the filing of the Annual Report on Form 10-K. The combination of a limited staff and the transitional status of our Chief Financial Officer resulted in ineffective oversight and monitoring controls over our year end financial reporting process. In light of these ineffective controls, we have concluded that there was more than a remote likelihood that a material misstatement of the annual or interim financial statements would not be prevented or detected, which constitutes a "material weakness" in our internal control over financial reporting as of December 31, 2004. These ineffective controls resulted in revisions to our draft financial statements and disclosures.

Example: Weakness related to Risk Assessment, Control Activities
Rent Way Inc.
PricewaterhouseCoopers issued a report dated December 28, 2001 to the Company's Audit Committee summarizing "reportable conditions" and "material weaknesses" as defined by the AICPA in the Company's internal control that was initially observed during PricewaterhouseCoopers' audit of the Company's financial statements for the fiscal year ended September 30, 2000. These conditions and weaknesses, which were discussed by PricewaterhouseCoopers with the Company's Audit Committee, concerned (1) the Company's need to conduct a risk assessment to be used in implementing a comprehensive system of effective internal control and (2) the Company's inability to reconcile its general ledger inventory amounts with the inventory amounts as reported by its point-of-sale inventory accounting system. PricewaterhouseCoopers issued a report dated December 27, 2002 to the Company's Audit Committee stating (1) that the reportable conditions and material weaknesses relating to the Company's need to conduct a risk assessment and implement an effective system of internal control had been resolved and (2) the reconciliation between the general ledger and point-of-sale system continued as a reportable condition. This reportable condition was discussed by PricewaterhouseCoopers with the Company's Audit Committee. This reportable condition was subsequently resolved by the Company during the fiscal year ended September 30, 2003. The Company has authorized PricewaterhouseCoopers to respond fully to the inquiries of Ernst & Young concerning the subject matter of the reportable events described above.

Appendix 3.A Examples of ERM

GRACE (W R) & CO (Filing date: 2006/03/13, Form: 10K, page F-62)

"The nature of our business requires us to deal with risks of several types. We seek to manage these risk factors so that the Company is exposed to an acceptable level of risk. We have established an **Enterprise Risk Management** function under our Chief Risk and Compliance Officer, the purpose of which is to provide assurance that management is addressing all risks facing the Company in a comprehensive and conservative way. The following are examples of how we are addressing certain categories of risks: "

POTASH CORP SASK INC (Filing date: 2006/03/09, Form: 10K, page 23)

" Our performance and future development could be materially affected by a wide range of risk factors. Any or all of these risks could have a material adverse effect on our business, financial condition, results of operations and cash flows and on the market price of our common stock. We use an **integrated risk management framework** to identify risks across all segments of the Company, evaluate those risks, and implement strategies designed to mitigate those risks. Our strategies to mitigate these risks are described under "Managing Risk" on pages 20 through 22 in the Financial Review section of our 2005 Annual Report, attached as Exhibit 13, incorporated herein by reference

ALLSTATE CORP (Filing date: 2005/11/01, Form: 10Q, page 26)

"The overarching intent of our catastrophe management strategy is to support profitable growth of our homeowners business. While in many areas of the country we are currently achieving returns within acceptable risk management tolerances, our goal is to find solutions that support a continued yet prudent presence in catastrophe prone markets. Allstate is introducing integrated **enterprise risk management ("ERM")** capabilities as part of our continued commitment to effective management of our capital, returns and risk profile. A principal ERM goal is to validate where and how we insure homeowners catastrophes and to further increase our return on equity, thereby lessening our earnings volatility and capital requirements. In introducing integrated ERM capabilities, we are considering and adopting new performance measurements for managing our homeowners business. These measurements currently include establishing an exposure limit based on hurricane and earthquake losses which have a one percent probability of occurring on an annual aggregate countrywide basis, refining acceptable targeted rates of return by line and by state and evaluating potential capital impairment measurements. Actions resulting from the evaluation of these measurements will reduce our catastrophe risk and improve long-term returns."

Appendix 3.B List of 114 ERM firms

Company Name	Company Name	Company Name
3M CO	FRANKLIN RESOURCES INC	OGE ENERGY CORP
ACXIOM CORP	FRIEDMN BILLINGS RMSY -CL A	PEDIATRIC SVCS AMERICA INC
AGL RESOURCES INC	FTI CONSULTING INC	PEPCO HOLDINGS INC
AIR PRODUCTS & CHEMICALS	GATX CORP	PEPSICO INC
ALCAN INC	GENERAL ELECTRIC CO	PHOENIX COMPANIES INC
ALCOA INC	GENERAL MOTORS CORP	PIEDMONT NATURAL GAS CO
ALLEGHENY ENERGY INC	GOLDMAN SACHS GROUP INC	PIPER JAFFRAY COS INC
ALLSTATE CORP	GRACE (W R) & CO	PITNEY BOWES INC
AMERICAN ELECTRIC POWER	GREAT PLAINS ENERGY INC	PLAINS ALL AMER PIPELNE -LP
AMERICAN INTERNATIONAL GROUP	HANDLEMAN CO	PNM RESOURCES INC
AMN HEALTHCARE SERVICES	HEALTHSOUTH CORP	POTASH CORP SASK INC
ANWORTH MTG ASSET CORP	IDACORP INC	PPL CORP
APACHE CORP	ILLUMINA INC	PROGRESS ENERGY INC
AVISTA CORP	IMPAC MORTGAGE HOLDINGS	PUBLIC SERVICE ENTRP GRP INC
BEAR STEARNS COMPANIES	IMPERIAL SUGAR CO	PUGET ENERGY INC
BEARINGPOINT INC	INDEPENDENCE HOLDING CO	RAYMOND JAMES FINANCIAL
BLACK HILLS CORP	INNOSPEC INC	REINSURANCE GROUP AMER INC
BOSTON SCIENTIFIC CORP	INTERPUBLIC GROUP OF COS	SAFECO CORP
BUNGE LTD	INTL GAME TECHNOLOGY	SAKS INC
CABOT CORP	KEYSPAN CORP	SIERRA PACIFIC RESOURCES
CATAPULT COMMUNICATIONS	KINDER MORGAN ENERGY -LP	SIGMATRON INTERNATIONAL INC
CHESAPEAKE UTILITIES CORP	KINDER MORGAN INC	SMUCKER (JM) CO
CLECO CORP	KINDRED HEALTHCARE INC	SOUTH JERSEY INDUSTRIES INC
CMS ENERGY CORP	LEGG MASON INC	TESORO CORP
CONSTELLATION ENERGY GRP	LEHMAN BROTHERS HOLDINGS	TEXTRON INC
CRAWFORD & CO	LENNAR CORP	TXU CORP
CROSSTEX ENERGY LP	LIONBRIDGE TECHNOLOGIES INC	UGI CORP
CUMMINS INC	MARRIOTT INTL INC	UNISOURCE ENERGY CORP
DUKE ENERGY CORP	MBIA INC	VECTREN CORP
EDISON INTERNATIONAL	MCF CORP	VECTREN UTILITY HOLDINGS INC
EL PASO CORP	MENTOR CORP	WEBMETHODS INC
ENBRIDGE ENERGY PRTNRS	MERRILL LYNCH & CO INC	XCEL ENERGY INC
ENERGY WEST INC	MGIC INVESTMENT CORP/WI	XTO ENERGY INC
ENTERCOM COMMUNICATIONS	MGP INGREDIENTS INC	ZOLL MEDICAL CORP
EQUITABLE RESOURCES INC	MORGAN STANLEY	
EXELON CORP	NESTOR INC	
FERRELLGAS PARTNERS -LP	NEW JERSEY RESOURCES CORP	
FIRSTENERGY CORP	NEWTEK BUSINESS SERVICES INC	
FLUOR CORP	NICOR INC	
FORD MOTOR CO	NORTHEAST UTILITIES	

Appendix 3.C Probit Model for Determinants of ERM Adoption

$$Prob(ERM_i = 1) = \beta_0 + \beta_1 Big4_i + \beta_2 FS_i + \beta_3 ZScore_i + \beta_4 DE\ Ratio_i$$
$$+ \beta_5 Investment\ Opportunity_i + \beta_6 Foreign\ Transaction_i + \varepsilon_i$$

Variables	Dependent Variable
	ERM
	Coefficients
	(Pr> χ^2)
β_0 (Intercept)	3.380
	(<0.001)
β_1 *(Big4)*	-0.071
	(0.441)
β_2 *(Size)*	-0.239
	(<0.001)
β_3 *(Z-Score)*	0.003
	(0.037)
β_4 *(DERatio)*	-0.006
	(0.241)
β_5 *(Investment Opportunity)*	1.545
	(0.012)
β_6 *(Foreign Transactions)*	0.582
	(<0.001)
Number of ERM firms	244
Number of Non-ERM firms	7,232
Likelihood Ratio Score	511.265
(Pr> χ^2)	(<0.001)

ERM_i is an indicator variable about whether firm *i* engages in ERM ($ERM_i = 1$) or did not engage in ERM ($ERM_i = 1$) at any point during 2005. $Big4_i$ is a dummy variable and is set to one if firm *i*'s auditor is from big four CPA firms, or set to zero otherwise. FS_i stands for firm size and is measured as the logarithm of firm *i*'s total assets (Compustat #6). $ZScore_i$ is the Z-score developed following Altman (1968). $DE\ Ratio_i$ is to divide total debt (Compustat #9 + Compustat#34) by stockholder's equity (Compustat #216). $Investment\ Opportunity_i$ is the sum of capital expenditure (Compustat #128) and R&D expenditures (Compustat #46) scaled by firm's total assets. $Foreign\ Transaction_i$ in a dummy takes on a value of one if firm *i* has none zero foreign currency adjustment (Compustat #150) in 2005, and zero otherwise.

Appendix 3.D ERM Index (*ERMI*)

$$ERMI \text{ (ERM Index)} = \sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k$$

Indicator	Definition
$Strategy_1$	$Strategy_1 = (Sales_i - \mu_{Sales})/\sigma_{Sales}$, where $Sales_i$ =Sales of firm i in 2005, μ_{Sales} = average industry sales in 2005, and σ_{Sales} = standard deviation of sales of all firms in the same industry.
$Strategy_2$	$Strategy_2 = (\Delta\beta_i - \mu_{\Delta\beta})/\sigma_{\Delta\beta}$, where $\Delta\beta_i$ = - (β_i in 2005 - β_i in 2004), β_i = firm i 's beta (data from Compustat), $\mu_{\Delta\beta}$ = average industry $\Delta\beta$ in 2005, and $\sigma_{\Delta\beta}$ = standard deviation of $\Delta\beta$'s of all firms in the same industry.
$Operation_1$	$Operation_1 = (Sales$ Compustat #6)/(*Total Assets* Compustat #12).
$Operation_2$	$Operation_2 = Sales/$ (*Number of Employees* Compustat #29).
$Reporting_1$	$Reporting_1 = (Material\ Weakness)+(Auditor\ Opinion)+(Restatement)$, where *Material Weakness* is set to -1 if a firm discloses any material weakness in its 10K, otherwise is set to 0; *Auditor Opinion* is set equal to 0 if a firm has unqualified opinions in its 10K, otherwise it is set to -1; and *Restatement* is set to -1 if a firm announced a restatement in 2005, otherwise it is set to 0 (data is from GAO, 2006).
$Reporting_2$	$Reporting_2 = \|NormalAccruals\|/(\|NormalAccruals\| + \|AbnormalAccruals\|)$, where *AbnormalAccruals* is the error term from the regression model $TA_{ijt}/A_{ijt-1} = \alpha_{jt}[1/A_{ijt-1}] + \beta_{1jt}[\Delta REV_{ijt}/A_{ijt-1}] + \beta_{2jt}[PPE_{ijt}/A_{ijt-1}] + e_{ijt}$, TA_{ijt} = total accruals and is defined as income before extraordinary items (Compustat #18) minus operating cash flows (Compustat #308)), A_{ijt-1} = total assets (Compustat #6), ΔREV_{ijt} = change in net revenues (Compustat #12), PPE_{ijt} = gross property plant and equipment (Compustat #8), e_{ijt} = error term, *NormalAccruals* is defined as TA_{ijt} minus *AbnormalAccruals*.
$Compliance_1$	$Compliance_1 = Auditor\ Fees/Total\ Assets$, where data for *Audit Fees* is hand collected from firm's proxy statements and data for *Total Assets* is from Compustat #6.
$Compliance_2$	$Compliance_2 = Settlement\ Net\ Gain/Total\ Assets$, where data for *Settlement Net Gain* and *Total Assets* are from Compustat #372 and #6, respectively.

Notes:

1. Each of the eight indicators is standardized among all ERM firms before being combined.

2. Whenever the industry is mentioned, the industry is measured as all active firms with the same two digits SIC code in Compustat

Figure 2.1 Time Series of Yearly Averaged Market-value Deflated by Asset (MV/TA): 10K-only MW group vs. Control group
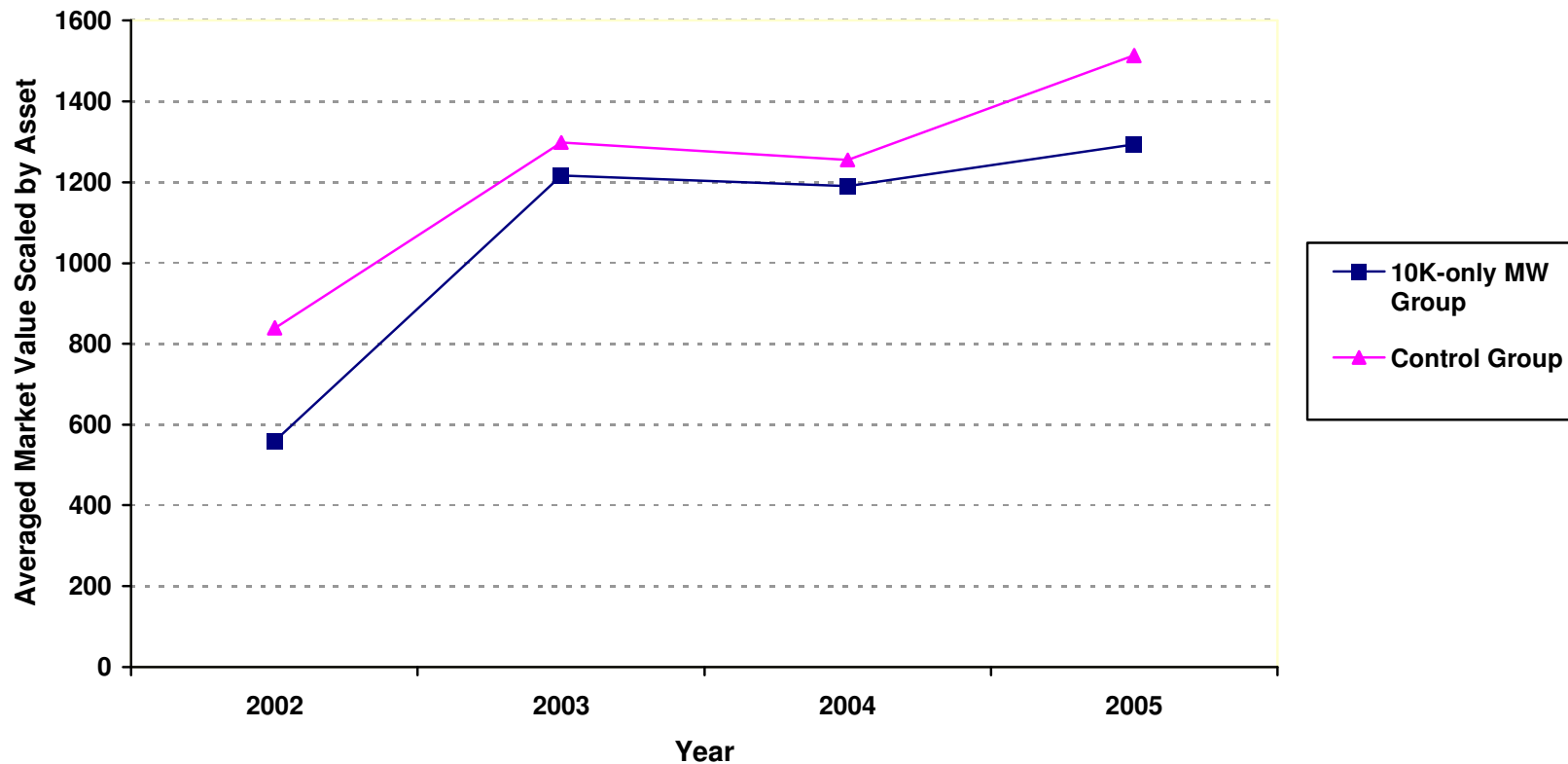
10K-only MW group are 594 firm-years with disclosures of material weaknesses in 10Ks from August 2002 through March 2006. Control group are 13,823 firm-years for firms that never disclose any material weakness from August 2002 through March 2006. Market-value (MV) is the stock price multiplied by shares outstanding [from CRSP] 91 days after year end for control group. For 10K-only MW group the stock price is on the later date of actual filing date and 91 days after year end. Data for total assets (TA) come from Compustat #6. MV/TA is averaged for 10K-only MW group and control group separately ever fiscal year from 2002 to 2005.

Figure 3.1 Contingency View of ERM and Firm Performance

Contingency Variables

ERM	**Proper Match**

- Environment Uncertainty
- Competition within Industry
- Firm Complexity
- Firm Size
- Monitoring by Board of Director

Firm Performance
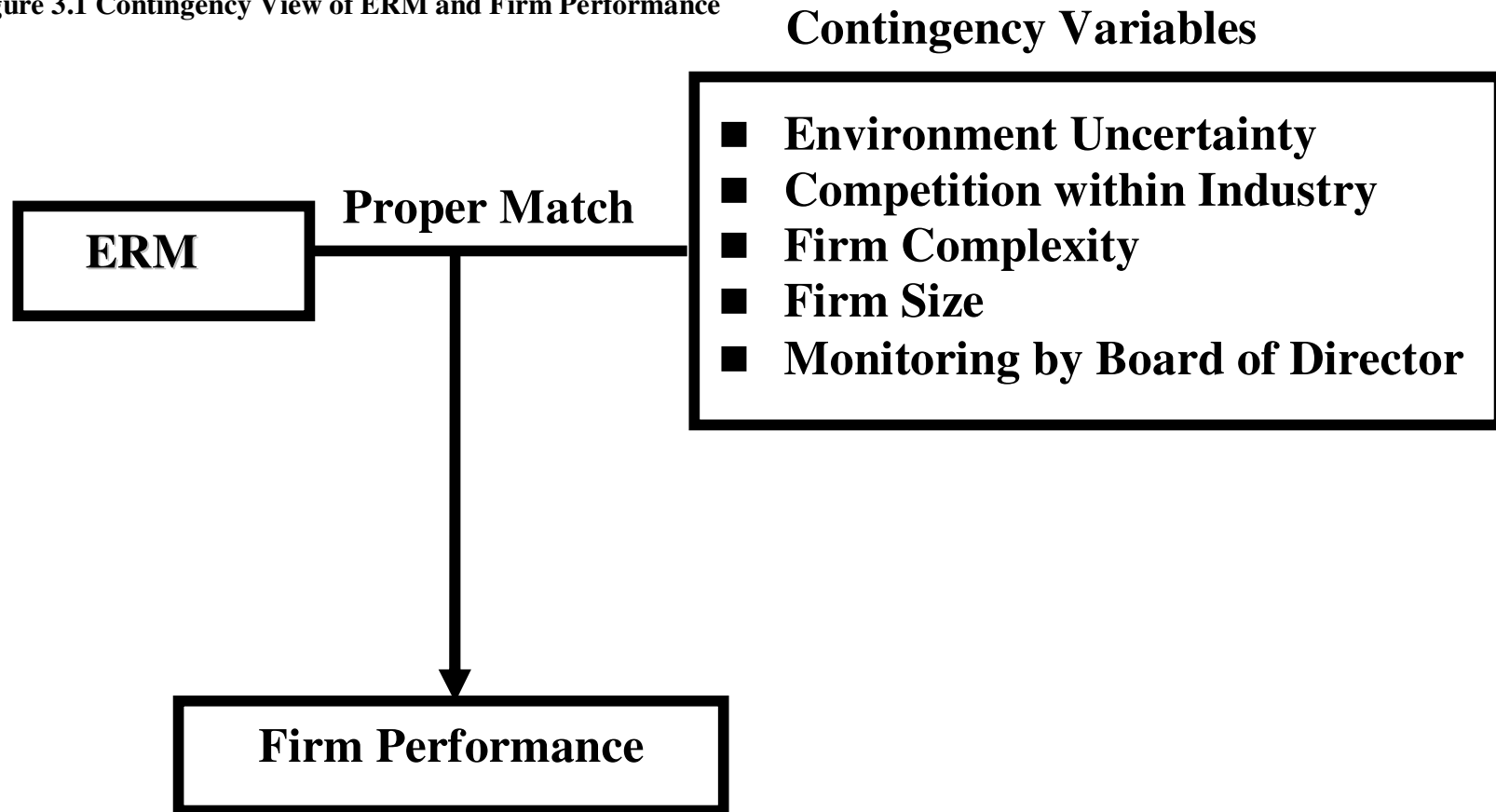
Table 2.1 Sample Selection

	Number of Observations
Material Weakness Sample:	
Identified material weakness disclosures from August 2002 to March 2006 (1,396 firms)	1,585
Less disclosures not in 10K, 10K/A, 10KSB, or 10KSB/A (349 firms)	(364)
Less firm-years not covered by Compustat	(181)
Less firm-years with unavailable data for empirical test	(306)
Total material weakness sample	708
Material weakness sample in 10K/A	(106)
Material weakness sample in 10KSB	(6)
Material weakness sample in 10KSB/A	(2)
10K-only material weakness sample	594
Compustat Control Sample:	
All Compustat firm-years from 2002 to 2005	23,750
Less firms identified as having at least one disclosure of material weakness from August 2002 to March 2006 (1,396 firms)	(5,024)
Less firm-years with unavailable data for empirical test	(5,273)
Outliers[*]	(247)
Total control sample used in multivariate regressions	13,206

[*] Outliers are firm-years with 1% from each of the variables MV_t/TA_t, BV_t/TA_t, and AE_t/TA_t.

MV is the firm's market-value, measured as the stock price multiplied by shares outstanding [from CRSP] 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. TA is firm's total asset [Compustat #6]. .

Table 2.2 Descriptive Statistics of Material Weakness Sample versus Compustat Control Sample

Variables	Material Weakness Sample		Compustat Control Firms (Non-Material Weakness Firms)		t-test of mean differences
	Mean	Standard Deviation	Mean	Standard Deviation	Two-tailed p-value
MV	1,632,470.410	9,076,890.520	2,495,623.810	11,903,122.320	0.016
BV	808.193	5,686.59	1,187.980	5,607.680	0.038
AE	-15.678	335.591	22.770	379.501	<0.001
MV / TA	1,159.560	1,127.200	1,154.620	1,361.370	0.911
BV / TA	0.419	0.310	0.422	0.304	0.722
AE / TA	0.001	0.079	0.014	0.090	<0.001
TA	5,944.630	57,606.31	6,297.57	50,195.850	0.830
AGGREGATE LOSS	0.446	0.497	0.277	0.448	<0.001
FOREIGN TRANSACTIONS	0.265	0.442	0.169	0.375	<0.001
SALES GROWTH	4.106	121.908	0.181	3.789	<0.001
RESTRUCTURING CHARGE	0.003	0.013	0.003	0.018	0.353

MV is the firm's market-value, measured as the stock price multiplied by shares outstanding [from CRSP] 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. *BV* is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t - R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. *TA* is firm's total asset [Compustat #6]. *AGGREGATE LOSS* is an indicator variable equal to one if earnings before extraordinary items [data item #18] in years t and t-1 sum to less than zero, and zero otherwise. *FOREIGN TRANSACTIONS* is an indicator variable equal to one if the firm has a non-zero currency transaction [Compustat #150] in year t and zero otherwise. *SALES GROWTH* is sales [Compustat #12] in year t minus the sales in year t-1 and then divided by sales in year t-1. *RESTRUCTURING CHARGE* is the restructuring charge [Compustat #376 * (-1)] in year t scaled by firm's asset [data item #6]

Table 2.3 Spearman\Pearson Correlation Analysis

	MW	MV /TA	BV /TA	AE /TA	TA	AGGREGATE LOSS	FOREIGN TRANSACTIONS	SALES GROWTH	RESTRUCTURING CHARGE
MW	1	0.001 (0.9252)	-0.003 (0.723)	-0.032 (<0.001)	-0.001 (0.830)	0.074 (<0.001)	0.050 (<0.001)	0.031 (<0.001)	0.005 (0.476)
MV /TA	0.034 (<0.001)	1	0.396 (<0.001)	0.077 (<0.001)	-0.083 (<0.001)	0.101 (<0.001)	0.001 (0.925)	0.060 (<0.001)	-0.001 (0.886)
BV /TA	0.002 (0.799)	0.590 (<0.001)	1	-0.001 (0.277)	-0.107 (0.017)	0.004 (0.590)	0.094 (<0.001)	0.000 (0.999)	0.005 (0.497)
AE /TA	-0.047 (<0.001)	0.211 (<0.001)	0.117 (<0.001)	1	-0.017 (0.017)	0.129 (<0.001)	-0.006 (0.377)	0.004 (0.534)	-0.005 (0.509)
TA	0.054 (<0.001)	-0.350 (<0.001)	-0.347 (<0.001)	-0.052 (<0.001)	1	-0.058 (<0.001)	0.036 (<0.001)	-0.001 (0.914)	-0.013 (0.080)
AGGREGATE LOSS	0.074 (<0.001)	0.069 (<0.001)	0.059 (<0.001)	0.032 (<0.001)	-0.181 (<0.001)	1	0.061 (<0.001)	0.013 (0.070)	0.150 (<0.001)
FOREIGN TRANSACTIONS	0.050 (<0.001)	0.020 (0.021)	0.104 (<0.001)	0.047 (<0.001)	0.233 (<0.001)	0.061 (<0.001)	1	-0.002 (0.772)	0.062 (<0.001)
SALES GROWTH	0.046 (<0.001)	0.231 (<0.001)	0.104 (<0.001)	0.255 (<0.001)	0.241 (<0.001)	-0.193 (<0.001)	0.096 (<0.001)	1	-0.002 (0.740)
RESTRUCTURING CHARGE	0.033 (<0.001)	0.004 (0.602)	0.003 (0.666)	-0.035 (<0.001)	0.114 (<0.001)	0.122 (<0.001)	0.137 (<0.001)	-0.097 (<0.001)	1

MW_t is an indicator variable that is equal to one if the firm disclosed a material weakness in 10K, 10KSB, or amendment of annual report in year t in our sample period (August 2002 to March 2006), and zero otherwise. MV is the firm's market-value, measured as the stock price multiplied by shares outstanding [from CRSP] 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t - R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. TA is firm's total asset [Compustat #6]. *AGGREGATE LOSS* is an indicator variable equal to one if earnings before extraordinary items [data item #18] in years t and t-1 sum to less than zero, and zero otherwise. *FOREIGN TRANSACTIONS* is an indicator variable equal to one if the firm has a non-zero currency transaction [Compustat #150] in year t and zero otherwise. *SALES GROWTH* is sales [Compustat #12] in year t minus the sales in year t-1 and then divided by sales in year t-1. *RESTRUCTURING CHARGE* is the restructuring charge [Compustat #376 * (-1)] in year t scaled by firm's asset [data item #6]

Table 2.4 Market Valuation of Disclosures of Material Weaknesses

$$MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 MW_t + \sum_{i=1}^{n} \beta_{4i} Industry_i + \sum_{j=1}^{T} \beta_{5j} Year_j$$

Independent Variables	Predicted Signs	All MW firms	10K-only MW firms	Inverse Mills Ratio (10K-only MW firms)	Propensity Score Matching (10K-only MW firms)
		Selectivity Control Method Dependent Variable= MV_t/TA_t			
		Coeff Est (p-value)	Coeff Est (p-value)	Coeff Est (pr> χ^2)	Coeff Est (p-value)
Intercept		123.609	146.071	374.841	686.719
		(0.573)	(0.513)	(0.096)	(<0.001)
BV_t/TA_t	+	1,105.337	1,103.993	1,108.430	1,899.534
		(<0.001)	(<0.001)	(<0.001)	(<0.001)
AE_t/TA_t	+	829.146	820.243	920.800	2,829.208
		(<0.001)	(<0.001)	(<0.001)	(<0.001)
MW_t	−	**-159.776**	**-169.869**	**-2,265.122**	**-222.170**
		(0.001)	**(0.001)**	**(<0.001)**	**(0.018)**
Industry Indicators		Included	Included	Included	
$Year_1$ (2003)		451.235	451.235	441.886	
		(<0.001)	(<0.001)	(<0.001)	
$Year_2$ (2004)		393.137	393.484	372.357	
		(<0.001)	(<0.001)	(<0.001)	
$Year_3$ (2005)		425.657	431.874	408.747	
		(<0.001)	(<0.001)	(<0.001)	
Number of Material Weakness Obs		708	594	594	594
Number of Total Obs		13,934	13,800	13,800	1,188
Adjusted R^2		27.39%	27.37%	27.46%	6.08%

MW_t is an indicator variable that is equal to one if the firm disclosed a material weakness in 10K, 10KSB, or amendment of annual report in year t in our sample period (August 2002 to March 2006), and zero otherwise. MV is the firm's market-value, measured as the stock price multiplied by shares outstanding [from CRSP] 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t - R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. TA is firm's total asset [Compustat #6]. Industry Indicators are set to one if the firm is in a particular industry, or to zero otherwise. Industry classification is based on firm's first two digits of SIC code, following Barth et al (1998). Year is set to one for the current year or zero if otherwise.

Table 2.5 Market Valuation of Disclosures of Material Weaknesses: FRIC vs. MTRIC

$$MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 FR_t + \beta_4 MTR_t + \sum_{i=1}^{n} \beta_{5i} Industry_i + \sum_{j=1}^{T} \beta_{6j} Year_j$$

Independent Variables	Predicted Signs	Selectivity Control Method Dependent Variable= MV_t/TA_t		
		All MW firms	10K-only MW firms	Propensity Score Matching (10K-only MW firms)
		Coeff Est (p-value)	Coeff Est (p-value)	Coeff Est (p-value)
Intercept		122.421	145.334	687.903
		(0.576)	(0.516)	(<0.001)
BV_t/TA_t	+	1,105.234	1,103.843	1,895.609
		(<0.001)	(<0.001)	(<0.001)
AE_t/TA_t	+	829.087	820.322	2,886.858
		(<0.001)	(<0.001)	(<0.001)
FR_t	−	**-141.607**	**-146.323**	**-112.401**
		(0.021)	**(0.035)**	**(0.579)**
MTR_t	−	**-181.827**	**-193.899**	**-335.770**
		(0.007)	**(0.006)**	**(0.102)**
Industry Indicators		Included	Included	
$Year_1$ (2003)		451.211	451.192	
		(<0.001)	(<0.001)	
$Year_2$ (2004)		392.974	393.337	
		(<0.001)	(<0.001)	
$Year_3$ (2005)		425.641	431.800	
		(<0.001)	(<0.001)	
Number of Material Weakness Obs		708	594	594
Number of Total Obs		13,934	13,800	1,188
Adjusted R^2		27.39%	27.37%	6.08%

FR_t is set to one if a disclosure of material weaknesses in reporting-only controls, or to zero otherwise. MTR_t is set to one if a disclosure of material weaknesses in more-than-reporting controls, or to zero otherwise. MV is the firm's market-value, measured as the stock price multiplied by shares outstanding [from CRSP] 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t - R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. TA is firm's total asset [Compustat #6]. Industry Indicators are set to one if the firm is in a particular industry, or to zero otherwise. Industry classification is based on firm's first two digits of SIC code, following Barth et al (1998). $Year$ is set to one for the current year or zero if otherwise.

Table 2.6 Market Valuation of Disclosures of Material Weaknesses: COSO (1992) Five Control Components

$$MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 E_t + \beta_4 R_t + \beta_5 A_t + \beta_6 I_t + \beta_7 M_t + \sum_{i=1}^{n} \beta_{8i} Industry_i + \sum_{j=1}^{T} \beta_{9j} Year_j$$

Independent Variables	Selectivity Control Method Dependent Variable= MV_t/TA_t		
	All MW firms	10K-only MW firms	Propensity Score Matching (10K-only MW firms)
	Coeff Est (p-value)	Coeff Est (p-value)	Coeff Est (p-value)
Intercept	116.195 (0.596)	140.686 (0.529)	631.769 (<0.001)
BV_t/TA_t	1,105.387 (<0.001)	1,104.388 (<0.001)	1,918.900 (<0.001)
AE_t/TA_t	831.667 (<0.001)	823.615 (<0.001)	2,952.225 (<0.001)
E_t	**-3.117** **(0.974)**	**-8.345** **(0.935)**	**223.457** **(0.369)**
R_t	**260.849** **(0.399)**	**228.140** **(0.477)**	**275.686** **(0.718)**
A_t	**-161.882** **(0.053)**	**-145.661** **(0.111)**	**-229.356** **(0.309)**
I_t	**-83.948** **(0.210)**	**-98.499** **(0.192)**	**-58.452** **(0.770)**
M_t	**75.189** **(0.479)**	**95.958** **(0.393)**	**-138.869** **(0.613)**
Industry Indicators	Included	Included	
$Year_1$ (2003)	450.818 (<0.001)	450.763 (<0.001)	
$Year_2$ (2004)	391.355 (<0.001)	391.254 (<0.001)	
$Year_3$ (2005)	425.789 (<0.001)	431.832 (<0.001)	
Number of Material Weakness Obs	708	594	594
Number of Total Obs	13,934	13,800	1,188
Adjusted R^2	27.38%	27.35%	5.81%

E_t R_t A_t I_t and M_t are set to one if a disclosure of material weaknesses is respectively related to the COSO (1992) five control components, or to zero otherwise. MV is the firm's market-value, measured as the stock price multiplied by shares outstanding 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t$ - $R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. TA is firm's total asset [Compustat #6]. Industry Indicators are set to one if the firm is in a particular industry, or to zero otherwise. $Year$ is set to one for the current year or zero if otherwise.

Table 2.7 Market Valuation of Repetitive Disclosures of Material Weaknesses

Model 1: $MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 Occur_t$

Model 2: $MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 Occur_t + \beta_4 Occur_t \times MTR_t$

Model 3:

$MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 Occur_t + \beta_4 Occur_t \times MTR_t + \beta_5 Occur_t \times E_t$

	Dependent Variable= MV_t/TA_t			
	Model 1	Model 2	Model 3	Propensity Score Matching
	Coeff Est	Coeff Est	Coeff Est	Coeff Est
Independent Variables	(p-value)	(p-value)	(p-value)	(pr> χ^2)
Intercept	297.424	305.630	271.282	288.436
	(0.842)	(0.838)	(0.855)	(0.848)
BV_t/TA_t	901.870	902.927	927.586	861.659
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
AE_t/TA_t	-844.973	-806.377	-825.745	-761.215
	(0.052)	(0.054)	(0.048)	(0.070)
$Occur_t$	**143.917**	**328.788**	**-58.520**	**-743.601**
	(0.573)	**(0.343)**	**(0.266)**	**(0.643)**
$Occur_t \times MTR_t$		**-389.003**	**-551.292**	**-1,303.930**
		(0.429)	**(0.266)**	**(0.160)**
$Occur_t \times E_t$			**1,149.740**	**871.460**
			(0.022)	**(0.351)**
Industry Indicator	Included	Included	Included	Included
$Year_1$ (2003)	490.779	487.161	491.343	478.350
	(0.179)	(0.182)	(0.177)	(0.191)
$Year_2$ (2004)	400.318	403.295	416.990	397.395
	(0.227)	(0.223)	(0.206)	(0.231)
$Year_3$ (2005)	520.496	512.588	532.125	542.186
	(0.157)	(0.164)	(0.147)	(0.139)
Number of Repeat Material Weakness Obs	38	38	38	38
Number of Total Material Weakness Obs	594	594	594	594
Adjusted R^2	5.86%	5.80%	6.56%	5.95%

$Occur_t$ is an indicator variable that is equal to one for a disclosure of material weakness in 10K if the firm has prior history of disclosing material weaknesses in annual repots through out our sample period (August 2002 to March 2006), and zero otherwise. MV is the firm's market-value, measured as the stock price multiplied by shares outstanding 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t - R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. TA is firm's total asset [Compustat #6]. Industry Indicators are set to one if the firm is in a particular industry, or to zero otherwise. $Year$ is set to one for the current year or zero if otherwise.

Table 2.8 Market Valuation of Material Weaknesses Disclosed in Amended 10Ks

Model 1: $MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 Amend_t$

Model 2: $MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 Amend_t + \beta_4 Amend_t \times MTR_t$

Model 3:

$MV_t/TA_t = \beta_0 + \beta_1\, BV_t/TA_t + \beta_2\, AE_t/TA_t + \beta_3 Amend_t + +\beta_4 Amend_t \times MTR_t + \beta_5 Amend_t \times E_t$

Independent Variables	Dependent Variable= MV_t/TA_t			
	Model 1	Model 2	Model 3	Propensity Score Matching
	Coeff Est	Coeff Est	Coeff Est	Coeff Est
	(p-value)	(p-value)	(p-value)	(pr> χ^2)
Intercept	-15.764	-25.648	-37.767	685.704
	(0.988)	(0.980)	(0.971)	(0.508)
BV_t/TA_t	915.804	915.651	920.516	969.140
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
AE_t/TA_t	-763.595	-765.111	-774.113	-721.050
	(0.048)	(0.047)	(0.045)	(0.060)
$Amend_t$	**-96.839**	**-80.516**	**-55.096**	**-2,642.128**
	(0.530)	**(0.638)**	**(0.755)**	**(<0.001)**
$Amend_t \times MTR_t$		**-74.861**	**-15.417**	**-385.132**
		(0.826)	**(0.965)**	**(0.342)**
$Amend_t \times E_t$			**-234.916**	**-9.793**
			(0.562)	**(0.981)**
Industry Indicator	Included	Included	Included	Included
$Year_1$ (2003)	528.063	529.703	525.267	532.464
	(0.116)	(0.115)	(0.118)	(0.110)
$Year_2$ (2004)	411.956	414.101	410.375	403.422
	(0.176)	(0.175)	(0.179)	(0.182)
$Year_3$ (2005)	588.776	590.389	587.029	560.522
	(0.081)	(0.080)	(0.082)	(0.094)
Number of Material Weakness Obs in Amended 10Ks	106	106	106	106
Number of Total Material Weakness Obs	700	700	700	700
Adjusted R^2	9.50%	9.37%	9.27%	11.34%

$Amend_t$ is set to one if the firm disclosed material weakness in 10K amendment in year t through out our sample period (August 2002 to March 2006), and zero otherwise. MV is the firm's market-value, measured as the stock price multiplied by shares outstanding 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t - R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. TA is firm's total asset [Compustat #6]. Industry Indicators are set to one if the firm is in a particular industry, or to zero otherwise. $Year$ is set to one for the current year or zero if otherwise

Table 2.9 Market Valuation of Voluntary Disclosures of Material Weaknesses

Model 1: $MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 VD_t$

Model 2: $MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 VD_t + \beta_4 VD_t \times MTR_t$

Model 3: $MV_t/TA_t = \beta_0 + \beta_1 BV_t/TA_t + \beta_2 AE_t/TA_t + \beta_3 VD_t + +\beta_4 VD_t \times MTR_t + \beta_5 VD_t \times E_t$

Independent Variables	Dependent Variable= MV_t/TA_t			
	Model 1	Model 2	Model 3	Inverse Mills Ratio
	Coeff Est	Coeff Est	Coeff Est	Coeff Est
	(p-value)	(p-value)	(p-value)	(pr> χ^2)
Intercept	9.042	-56.389	-30.520	-991.241
	(0.993)	(0.957)	(0.977)	(0.344)
BV_t/TA_t	945.392	943.310	954.577	987.710
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
AE_t/TA_t	-757.399	-779.674	-825.748	-624.416
	(0.050)	(0.044)	(0.034)	(0.108)
VD_t	**-76.662**	**-170.063**	**-101.384**	**3,102.960**
	(0.721)	**(0.478)**	**(0.686)**	**(<0.001)**
$VD_t \times MTR_t$		**221.411**	**275.385**	**-356.879**
		(0.382)	**(0.289)**	**(0.298)**
$VD_t \times E_t$			**-242.440**	**273.692**
			(0.353)	**(0.435)**
Industry Indicator	Included	Included	Included	Included
$Year_1$ (2003)	513.110	562.993	542.529	537.177
	(0.127)	(0.099)	(0.113)	(0.108)
$Year_2$ (2004)	326.842	393.010	361.249	428.164
	(0.360)	(0.282)	(0.325)	(0.159)
$Year_3$ (2005)	487.207	556.279	524.411	596.730
	(0.212)	(0.162)	(0.189)	(0.075)
Number of Voluntarily-Disclosed Material Weakness	131	131	131	131
Number of Total Material Weakness Obs	708	708	708	708
Adjusted R^2	9.68%	9.64%	9.62%	11.33%

VD_t is set to one if a voluntary disclosure, or to zero otherwise. MV is the firm's market-value, measured as the stock price multiplied by shares outstanding 91 days after year end for control group. For material weakness sample the stock price is on the later date of actual filing date and 91 days after year end. BV is the firm's book value of equity at year end [Compustat #216]. $AE_t = NI_t - R_t \times BV_{t-1}$, where NI_t is the net income [Compustat #58] and R_t is the average of 12 monthly interest rates of 5-year government notes in year t. TA is firm's total asset [Compustat #6]. Industry Indicators are set to one if the firm is in a particular industry, or to zero otherwise. *Year* is set to one for the current year or zero if otherwise

Table 3.1 Industry Distribution of the Sample

Industry	Number of Observations	Percentage
Utility	41	35.96%
Financial Trading	13	11.40%
Business Service	9	7.89%
Insurance	9	7.89%
Drugs	6	5.26%
Lab Equipment	5	4.39%
Energy	4	3.51%
Food	4	3.51%
Autos	3	2.63%
Health	3	2.63%
Construction	2	1.75%
Machinery	2	1.75%
Retail	2	1.75%
Steel	2	1.75%
Transportation	2	1.75%
Chips	1	0.88%
Meals	1	0.88%
Miscellaneous	1	0.88%
Paper	1	0.88%
Telecommunication	1	0.88%
Toys	1	0.88%
Wholesale	1	0.88%
Total	114	100%

Note: Industry classification is based on Fama and French industry classification for SIC two-digit codes (see Appendix A of Fama and French, 1997).

Table 3.2 Summary Statistics

Variables	Total Sample Mean	Total Sample Std dev	High Performing Firms (Excess Return>2%) Mean	High Performing Firms (Excess Return>2%) Std dev	The Other Firms (Excess Return≤2%) Mean	The Other Firms (Excess Return≤2%) Std dev	Test of Differences in Means Difference[a]	Test of Differences in Means P-value
P	1.050	26.681	21.533	18.495	-17.384	18.071	38.917	<0.001
ERMI	0.000	2.625	-0.073	2.271	0.066	2.926	-0.140	0.776
EU	2.086	1.182	2.160	1.382	2.020	0.975	0.140	0.531
CI	0.954	0.051	0.953	0.056	0.955	0.046	-0.002	0.829
FC	0.473	0.231	0.456	0.222	0.487	0.239	-0.031	0.476
FS	8.694	2.153	8.988	2.047	8.428	2.228	0.560	0.165
MBD	1.250	0.305	1.256	0.282	1.245	0.327	0.011	0.846
Number of Observations	114		54		60			

P (firm performance) is measured by the one-year excess stock market return at the year end of 2005. *ERMI* (ERM

Index)= $\sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k$, where all indicators are defined in

Appendix D. *EU* (Environmental uncertainty)= $\log\left(\sum_{k=1}^{3} CV(X_k)\right)$, where $CV(X_k) = \sqrt{\sum_{t=1}^{5} (z_{k,t} - \overline{z}_k)^2 / 5} \Big/ |\overline{z}_k|$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty surrogate k in year t, k = 1 to 3 to represent market (sales, Compustat #12), technological (sum of R&D Compustat #46 and capital expenditures Compustat #128 divided by total assets Compustat #6) or income (net income, Compustat #170) uncertainty, and $\overline{z}_k$ = mean of changes over 5 years of uncertainty surrogate k. *CI* (Competition Within Industry) is measured as *(1- HHI)*, where *HHI* represents the sum of squared market shares of all firms in the market and market share is each firm's sales (Compustat #12) divided by the total sales of the industry. *FC(Firm complexity)* is measured by the number of business segments (from Compustat Segments) for each firm. *FS(Firm size)* is measured as the natural logarithm of average total assets (Compustat #6). *MBD(Monitoring by Board of Director)* is measured by the number of directors for each firm divided by the natural logarithm of sales, where number of directors was hand collected from the 2005 10-K files of firms.

Table 3.3 Sample Spearman\Pearson Correlation Coefficients (N=114)

	P	ERMI	EU	CI	FC	FS	MBD
P	1	0.094 (0.319)	0.076 (0.424)	-0.035 (0.714)	-0.108 (0.251)	0.149 (0.114)	-0.049 (0.608)
ERMI	0.038 (0.691)	1	-0.181 (0.054)	-0.280 (0.003)	-0.063 (0.506)	-0.035 (0.708)	-0.264 (0.005)
EU	0.059 (0.533)	-0.192 (0.041)	1	0.042 (0.660)	-0.030 (0.754)	-0.066 (0.485)	0.219 (0.019)
CI	0.131 (0.165)	-0.303 (0.001)	0.104 (0.271)	1	0.141 (0.134)	-0.102 (0.278)	0.086 (0.362)
FC	-0.040 (0.674)	-0.153 (0.104)	-0.008 (0.936)	0.171 (0.069)	1	-0.054 (0.566)	0.068 (0.472)
FS	0.201 (0.032)	-0.075 (0.430)	0.056 (0.552)	0.028 (0.764)	0.032 (0.732)	1	-0.454 (<0.001)
MBD	0.080 (0.397)	-0.278 (0.003)	0.196 (0.036)	0.178 (0.058)	0.068 (0.475)	-0.341 (<0.001)	1

P (firm performance) is measured by the one-year excess stock market return at the year end of 2005. *ERMI* (ERM

Index)= $\sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k$, where all indicators are defined in

Appendix D. *EU* (Environmental uncertainty)= $\log\left(\sum_{k=1}^{3} CV(X_k)\right)$, where $CV(X_k) = \sqrt{\sum_{t=1}^{5}(z_{k,t} - \overline{z_k})^2 / 5} \Big/ |\overline{z_k}|$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty surrogate *k* in year *t*, *k* = 1 to 3 to represent market (sales, Compustat #12), technological (sum of R&D Compustat #46 and capital expenditures Compustat #128 divided by total assets Compustat #6) or income (net income, Compustat #170) uncertainty, and $\overline{z_k}$ = mean of changes over 5 years of uncertainty surrogate *k*. *CI* (Competition Within Industry) is measured as *(1- HHI)*, where *HHI* represents the sum of squared market shares of all firms in the market and market share is each firm's sales (Compustat #12) divided by the total sales of the industry. *FC(Firm complexity)* is measured by the number of business segments (from Compustat Segments) for each firm. *FS(Firm size)* is measured as the natural logarithm of average total assets (Compustat #6). *MBD(Monitoring by Board of Director)* is measured by the number of directors for each firm divided by the natural logarithm of sales, where number of directors was hand collected from the 2005 10-K files of firms. Pearson correlations are reported above the diagonal, and Spearman correlations are reported below.

Table 3.4 Main Analysis

Panel A Regression of ERMI on Contingent Variables

$$ERMI_i = \beta_0 + \beta_1 EU_i + \beta_2 CI_i + \beta_3 FC_i + \beta_4 FS_i + \beta_5 MBD_i + \varepsilon_i$$

	Total Sample		High Performing Firms (Excess Return>2%)		The Other Firms (Excess Return≤2%)	
Number of Obs	114		54		60	
Variables	Coefficients (p-value)	VIF (Tolerance)	Coefficients (p-value)	VIF (Tolerance)	Coefficients (p-value)	VIF (Tolerance)
β_0 (Intercept)	19.423 (<0.001)	N/A (N/A)	20.626 (<0.001)	N/A (N/A)	16.126 (0.079)	N/A (N/A)
β_1 (EU)	-0.258 (0.196)	1.055 (0.948)	-0.217 (0.257)	1.098 (0.910)	-0.293 (0.481)	1.143 (0.875)
β_2 (CI)	-13.820 (0.003)	1.032 (0.969)	-12.707 (0.008)	1.093 (0.915)	-12.644 (0.138)	1.037 (0.963)
β_3 (FC)	-0.215 (0.830)	1.026 (0.974)	-2.283 (0.058)	1.094 (0.914)	1.227 (0.450)	1.049 (0.954)
β_4 (FS)	-0.260 (0.032)	1.269 (0.788)	-0.372 (0.007)	1.186 (0.843)	-0.162 (0.438)	1.508 (0.663)
β_5 (MBD)	-2.676 (0.002)	1.326 (0.754)	-2.977 (0.005)	1.278 (0.782)	-2.107 (0.145)	1.527 (0.655)
F-Statistic (p-value)	4.96 (<0.001)		6.98 (<0.001)		1.24 (0.305)	
R^2	0.187		0.421		0.103	

Panel B Residual Analysis (All 114 ERM Firms) $P_i = \beta_0 + \beta_1 ARES_i + \varepsilon_i$

Variable	Coefficients (p-value)
Intercept	6.622 (0.063)
ARES	-3.221 (0.029)
F-Statistic	4.87 (0.029)
R^2	0.042

P (firm performance) is measured by the one-year excess stock market return at the year end of 2005.

$ERMI$ (ERM Index)= $\sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k$, where all indicators are

defined in Appendix D. *EU* (Environmental uncertainty)= $\log\left(\sum_{k=1}^{3} CV(X_k)\right)$, where $CV(X_k) = \sqrt{\sum_{t=1}^{5}(z_{k,t} - \overline{z_k})^2 / 5} \Big/ \left|\overline{z_k}\right|$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty surrogate k in year t, k = 1 to 3 to represent market (sales, Compustat #12), technological (sum of R&D Compustat #46 and capital expenditures Compustat #128 divided by total assets Compustat #6) or income (net income, Compustat #170) uncertainty, and $\overline{z_k}$ = mean of changes over 5 years of uncertainty surrogate k. *CI* (Competition Within Industry) is measured as *(1- HHI)*, where *HHI* represents the sum of squared market shares of all firms in the market and market share is each firm's sales (Compustat #12) divided by the total sales of the industry. *FC(Firm complexity)* is measured by the number of business segments (from Compustat Segments) for each firm. *FS(Firm size)* is measured as the natural logarithm of average total assets (Compustat #6). *MBD(Monitoring by Board of Director)* is measured by the number of directors for each firm divided by the natural logarithm of sales, where number of directors was hand collected from the 2005 10-K files of firms.

$\widehat{ERMI}_i = 20.626 - 0.217\,EU_i - 12.707\,CI_i - 2.283\,FC_i - 0.372\,FS_i - 2.977\,MBD_i$. $ARES_i = \left|ERMI_i - \widehat{ERMI}_i\right|$.

Table 3.5 Propensity Matched sample

Panel A Univariate Test of Differences in Means

Variables	ERM Firms		Control Sample		Test of Differences in Means	
	Mean	Std dev	Mean	Std dev	Difference	P-value
P	1.050	26.681	6.216	37.925	-5.166	0.236
ERMI	0.271	2.664	-0.271	2.620	0.541	0.124
EU	2.086	1.182	1.981	1.187	0.106	0.501
CI	0.954	0.051	0.948	0.088	0.005	0.565
FC	0.473	0.231	0.394	0.722	0.079	0.270
FS	8.694	2.153	8.318	2.482	0.375	0.224
MBD	1.250	0.305	1.155	3.960	0.095	0.798
Number of Obs	114		114			

Panel B Regression of ERMI on Contingent Variables

$$ERMI_i = \beta_0 + \beta_1 EU_i + \beta_2 CI_i + \beta_3 FC_i + \beta_4 FS_i + \beta_5 MBD_i + \beta_6 ERM_i + \varepsilon_i$$

	Total Sample	High Performing Firms (Excess Return>2%)	The Other Firms (Excess Return ≤ 2%)
Number of Obs	228	112	116
Variables	Coefficients (p-value)	Coefficients (p-value)	Coefficients (p-value)
β_0 (Intercept)	5.832 (0.023)	13.721 (<0.001)	3.990 (0.348)
β_1 *(EU)*	-0.380 (0.010)	-0.258 (0.109)	-0.504 (0.071)
β_2 *(CI)*	-6.406 (0.017)	-13.463 (0.001)	-4.899 (0.264)
β_3 *(FC)*	-0.144 (0.825)	-0.478 (0.593)	0.300 (0.755)
β_4 *(FS)*	0.089 (0.241)	-0.022 (0.823)	0.135 (0.274)
β_5 *(MBD)*	0.036 (0.778)	0.015 (0.930)	0.001 (0.996)
β_6 *(ERM)*	0.591 (0.090)	0.324 (0.446)	0.700 (0.210)
F-Statistic (p-value)	2.80 (0.012)	2.99 (0.010)	1.36 (0.238)
R^2	0.071	0.146	0.070

Table C Residual Analysis (All 114 ERM Firms and 114 non-ERM Matched Firms)

$$P_i = \beta_0 + \beta_1 ARES_i + \varepsilon_i$$

Variable	Coefficients (p-value)
Intercept	10.835 (<0.001)
ARES	-3.825 (<0.001)
F-Statistic (p-value)	11.82 (<0.001)
R^2	0.050

P (firm performance) is measured by the one-year excess stock market return at the year end of 2005. *ERMI* (ERM

Index)= $\sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k$, where all indicators are defined in

Appendix D. *EU* (Environmental uncertainty)= $\log\left(\sum_{k=1}^{3} CV(X_k)\right)$, where $CV(X_k) = \sqrt{\sum_{t=1}^{5}(z_{k,t} - \overline{z}_k)^2 / 5} \Big/ |\overline{z}_k|$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty surrogate k in year t, k = 1 to 3 to represent market (sales, Compustat #12), technological (sum of R&D Compustat #46 and capital expenditures Compustat #128 divided by total assets Compustat #6) or income (net income, Compustat #170) uncertainty, and $\overline{z}_k$ = mean of changes over 5 years of uncertainty surrogate k. *CI* (Competition Within Industry) is measured as *(1- HHI)*, where *HHI* represents the sum of squared market shares of all firms in the market and market share is each firm's sales (Compustat #12) divided by the total sales of the industry. *FC(Firm complexity)* is measured by the number of business segments (from Compustat Segments) for each firm. *FS(Firm size)* is measured as the natural logarithm of average total assets (Compustat #6). *MBD(Monitoring by Board of Director)* is measured by the number of directors for each firm divided by the natural logarithm of sales, where number of directors was hand collected from the 2005 10-K files of firms.

$\widehat{ERMI}_i = 13.721 - 0.258\, EU_i - 13.463\, CI_i - 0.478\, FC_i - 0.022\, FS_i + 0.015\, MBD_i + 0.324\, ERM_i$. $ARES_i = \left| ERMI_i - \widehat{ERMI}_i \right|$.

Table 3.6 Different Cutoffs of High Performing Firms

Panel A Regression of ERMI on Contingency Variables $ERMI_i = \beta_0 + \beta_1 EU_i + \beta_2 CI_i + \beta_3 FC_i + \beta_4 FS_i + \beta_5 MBD_i + \varepsilon_i$

High Performing Firms are firms with one year excess return >

Variables	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Number of High-Perform	62	60	54	52	48	46	42	40	38	37	33
Variables	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)
β_0 (Intercept)	21.265 (<0.001)	21.019 (<0.001)	20.626 (<0.001)	20.239 (<0.001)	20.037 (<0.001)	19.734 (<0.001)	19.420 (<0.001)	19.833 (<0.001)	13.683 (0.012)	13.827 (0.013)	13.121 (0.019)
β_1 (EU)	-0.150 (0.388)	-0.154 (0.383)	-0.217 (0.257)	-0.204 (0.291)	-0.209 (0.259)	-0.203 (0.309)	-0.183 (0.385)	-0.155 (0.479)	-0.106 (0.624)	-0.111 (0.613)	-0.065 (0.784)
β_2 (CI)	-13.517 (0.001)	-13.317 (0.002)	-12.707 (0.008)	-12.494 (0.010)	-12.170 (0.009)	-12.100 (0.011)	-11.767 (0.019)	-11.463 (0.024)	-7.915 (0.105)	-8.029 (0.108)	-8.090 (0.116)
β_3 (FC)	-2.458 (0.017)	-2.395 (0.025)	-2.283 (0.058)	-2.384 (0.051)	-2.362 (0.044)	-2.259 (0.061)	-2.122 (0.108)	-2.453 (0.077)	-2.050 (0.114)	-2.112 (0.117)	-2.011 (0.171)
β_4 (FS)	-0.379 (0.003)	-0.358 (0.007)	-0.372 (0.007)	-0.341 (0.016)	-0.335 (0.014)	-0.330 (0.018)	-0.330 (0.035)	0.362 (0.027)	-0.246 (0.120)	-0.251 (0.122)	-0.176 (0.334)
β_5 (MBD)	-2.818 (0.003)	-2.929 (0.003)	-2.977 (0.005)	-3.016 (0.005)	-3.089 (0.003)	-2.994 (0.005)	-3.029 (0.010)	-3.232 (0.009)	-2.198 (0.067)	-2.166 (0.077)	-2.104 (0.096)
F-Statistic	8.24	7.98	6.98	6.76	7.54	6.48	5.23	5.15	2.27	2.20	1.98
(p-value)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.001)	(0.001)	(0.071)	(0.079)	(0.114)
R^2	0.424	0.425	0.421	0.424	0.473	0.448	0.421	0.431	0.262	0.262	0.268

Panel B Residual Analysis (All 114 ERM Firms) $P_i = \beta_0 + \beta_1 ARES_i + \varepsilon_i$

Variables	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)	Coef (p-val)
Intercept	6.771 (0.056)	6.810 (0.055)	6.622 (0.063)	6.693 (0.060)	6.770 (0.058)	6.713 (0.060)	6.772 (0.059)	7.034 (0.049)	6.226 (0.077)	6.207 (0.078)	6.327 (0.074)
ARES	-3.295 (0.025)	-3.321 (0.024)	-3.221 (0.029)	-3.264 (0.027)	-3.296 (0.026)	-3.273 (0.027)	-3.296 (0.027)	-3.407 (0.021)	-3.015 (0.039)	-3.007 (0.039)	-3.047 (0.037)
F-Statistic	5.20	5.23	4.87	5.02	5.08	4.99	5.02	5.50	4.37	4.36	4.45
(p-value)	(0.025)	(0.024)	(0.029)	(0.027)	(0.026)	(0.027)	(0.027)	(0.021)	(0.039)	(0.039)	(0.037)
R^2	0.044	0.045	0.042	0.043	0.043	0.043	0.043	0.047	0.038	0.038	0.038

P (firm performance) is measured by the one-year excess stock market return at the year end of 2005. *ERMI* (ERM

Index)= $\sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k$, where all indicators are defined in

Appendix D. *EU* (Environmental uncertainty)= $\log\left(\sum_{k=1}^{3} CV(X_k)\right)$, where $CV(X_k) = \sqrt{\sum_{t=1}^{5}(z_{k,t} - \overline{z_k})^2 / 5} \Big/ |\overline{z_k}|$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty surrogate k in year t, k = 1 to 3 to represent market (sales, Compustat #12), technological (sum of R&D Compustat #46 and capital expenditures Compustat #128 divided by total assets Compustat #6) or income (net income, Compustat #170) uncertainty, and $\overline{z_k}$ = mean of changes over 5 years of uncertainty surrogate k. *CI* (Competition Within Industry) is measured as *(1- HHI)*, where *HHI* represents the sum of squared market shares of all firms in the market and market share is each firm's sales (Compustat #12) divided by the total sales of the industry. *FC(Firm complexity)* is measured by the number of business segments (from Compustat Segments) for each firm. *FS(Firm size)* is measured as the natural logarithm of average total assets (Compustat #6). *MBD(Monitoring by Board of Director)* is measured by the number of directors for each firm divided by the natural logarithm of sales, where number of directors was hand collected from the 2005 10-K files of firms.

$\widehat{ERMI_i} = \hat{\beta}_0 + \hat{\beta}_1 EU_i + \hat{\beta}_2 CI_i + \hat{\beta}_3 FC_i + \hat{\beta}_4 FS_i + \hat{\beta}_5 MBD_i$. $ARES_i = \left| ERMI_i - \widehat{ERMI_i} \right|$.

Table 3.7 Alternative Measure for Monitoring by Board of Directors

Panel A Regression of ERMI on Contingent Variables

$$ERMI_i = \beta_0 + \beta_1 EU_i + \beta_2 CI_i + \beta_3 FC_i + \beta_4 FS_i + \beta_5 MBD_i + \varepsilon_i$$

	Total Sample	High Performing Firms (Excess Return>2%)	The Other Firms (Excess Return≤2%)
Number of Obs	63	30	33
β_0 (Intercept)	17.930 (0.002)	10.482 (0.219)	21.557 (0.008)
β_1 (EU)	-0.534 (0.026)	-0.683 (0.068)	-0.767 (0.028)
β_2 (CI)	-16.611 (0.518)	-12.452 (0.114)	-18.992 (0.010)
β_3 (FC)	-0.757 (0.518)	-1.996 (0.216)	0.885 (0.606)
β_4 (FS)	-0.092 (0.518)	0.244 (0.316)	-0.129 (0.515)
β_5 (MBD)	-0.006 (0.934)	0.065 (0.444)	-0.113 (0.305)
F-Statistic (p-value)	3.33 (0.010)	2.83 (0.038)	2.60 (0.048)
R^2	0.226	0.371	0.325

Panel B Residual Analysis (All 63 ERM Firms):

$$P_i = \beta_0 + \beta_1 ARES_i + \varepsilon_i$$

Variable	Coefficients[b] (p-value)
Intercept	12.595 (0.011)
ARES	-7.019 (0.005)
F-Statistic (p-value)	8.63 (0.005)
R^2	0.124

P (firm performance) is measured by the one-year excess stock market return at the year end of 2005. *ERMI* (ERM

Index)= $\sum\limits_{k=1}^{2} Strategy_k + \sum\limits_{k=1}^{2} Operation_k + \sum\limits_{k=1}^{2} Reporting_k + \sum\limits_{k=1}^{2} Compliance_k$, where all indicators are defined in

Appendix D. *EU* (Environmental uncertainty)= $\log\left(\sum\limits_{k=1}^{3} CV(X_k)\right)$, where $CV(X_k) = \sqrt{\sum\limits_{t=1}^{5}(z_{k,t} - \overline{z}_k)^2 / 5} \Big/ |\overline{z}_k|$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty surrogate k in year t, k = 1 to 3 to represent market (sales, Compustat #12), technological (sum of R&D Compustat #46 and capital expenditures Compustat #128 divided by total assets Compustat #6) or income (net income, Compustat #170) uncertainty, and $\overline{z}_k$ = mean of changes over 5 years of uncertainty surrogate k. *CI* (Competition Within Industry) is measured as *(1- HHI)*, where *HHI* represents the sum of squared market shares of all firms in the market and market share is each firm's sales (Compustat #12) divided by the total sales of the industry. *FC(Firm complexity)* is measured by the number of business segments (from Compustat Segments) for each firm. *FS(Firm size)* is measured as the natural logarithm of average total assets (Compustat #6). *MBD(Monitoring by Board of Director)* is measured by the number of board meetings for each firm in 2005, where the data is from

Compustat. $\widehat{ERMI}_i = 10.482 - 0.683 EU_i - 12.452 CI_i - 1.996 FC_i + 0.244 FS_i + 0.065 MBD_i$. $ARES_i = \left| ERMI_i - \widehat{ERMI}_i \right|$.

Table 3.8 Alternative Timing of Performance Measure
Panel A Regression of ERMI on Contingent Variables

$$ERMI_i = \beta_0 + \beta_1 EU_i + \beta_2 CI_i + \beta_3 FC_i + \beta_4 FS_i + \beta_5 MBD_i + \varepsilon_i$$

	Total Sample	High Performing Firms (Excess Return>2%)	The Other Firms (Excess Return≤2%)
Number of Obs	114	70	44
β_0 (Intercept)	19.423 (<0.001)	18.819 (<0.001)	20.824 (0.156)
β_1 (EU)	-0.258 (0.196)	-0.204 (0.333)	-0.303 (0.569)
β_2 (CI)	-13.820 (0.003)	-11.845 (0.015)	-17.171 (0.211)
β_3 (FC)	-0.215 (0.830)	-0.551 (0.668)	0.140 (0.938)
β_4 (FS)	-0.260 (0.032)	-0.282 (0.074)	-0.235 (0.300)
β_5 (MBD)	-2.676 (0.002)	-3.518 (<0001)	-1.460 (0.408)
F-Statistic (p-value)	4.96 (<0.001)	5.22 (<0.001)	0.66 (0.653)
R^2	0.187	0.290	0.080

Panel B Residual Analysis (All 114 ERM Firms)

$$P_i = \beta_0 + \beta_1 ARES_i + \varepsilon_i$$

Variable	Coefficients (p-value)
Intercept	17.667 (<0.001)
ARES	-4.538 (0.038)
F-Statistic (p-value)	4.40 (0.038)
R^2	0.124

P (firm performance) is measured by the one-year excess stock market return at the year end of 2005. $ERMI$ (ERM Index)= $\sum_{k=1}^{2} Strategy_k + \sum_{k=1}^{2} Operation_k + \sum_{k=1}^{2} Reporting_k + \sum_{k=1}^{2} Compliance_k$, where all indicators are defined in

Appendix D. EU (Environmental uncertainty)= $\log\left(\sum_{k=1}^{3} CV(X_k)\right)$, where $CV(X_k) = \sqrt{\sum_{t=1}^{5}(z_{k,t} - \overline{z}_k)^2 / 5} \Big/ \left|\overline{z}_k\right|$,

$z_{k,t} = (X_{k,t} - X_{k,t-1})$, $X_{k,t}$ = uncertainty surrogate k in year t, k = 1 to 3 to represent market (sales, Compustat #12), technological (sum of R&D Compustat #46 and capital expenditures Compustat #128 divided by total assets Compustat #6) or income (net income, Compustat #170) uncertainty, and $\overline{z}_k$ = mean of changes over 5 years of uncertainty surrogate k. CI (Competition Within Industry) is measured as $(1 - HHI)$, where HHI represents the sum of squared market shares of all firms in the market and market share is each firm's sales (Compustat #12) divided by the total sales of the industry. FC(Firm complexity) is measured by the number of business segments (from Compustat Segments) for each firm. FS(Firm size) is measured as the natural logarithm of average total assets (Compustat #6). MBD(Monitoring by Board of Director) is measured by the number of directors for each firm divided by the natural logarithm of sales, where number of directors was hand collected from the 2005 10-K files of firms.

$\widehat{ERMI}_i$ = 18.819-0.204EU_i -11.845CI_i -0.551FC_i -0.282FS_i -3.518MBD_i . $ARES_i = \left|ERMI_i - \widehat{ERMI}_i\right|$.

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