AN EXAMINATION OF BOND VALUATION IN THE PRESENCE OF LOSS CONTINGENCY DISCLOSURES: A CONTINUOUS-TIME FINANCE THEORY APPROACH

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

According to Statement of Financial Accounting Concepts No. 1: Objectives of Financial Reporting by Business Enterprises (SFAC, 1978), a primary objective of financial reporting is to provide information to present and potential investors and creditors that is useful in assessing the uncertainty of future cash receipts, such as proceeds from interest and matured securities (e.g., bonds). One class of events with the potential to impact on the cash flows ultimately realized by investors and creditors is loss contingencies. Statement of Financial Accounting Standards (SFAS) No. 5 (1975) defines a loss contingency as "an existing condition, situation or set of circumstances involving varying degrees of uncertainty which may result in loss of an asset or incurrence of a liability." Examples of loss contingencies include litigation initiated against the firm, guarantees of indebtedness of others, threat of expropriation of assets, and claims from product warranty obligations.

The SFAS No. 5 requires firms to disclose loss contingencies in a narrative footnote to the financial statements if a loss is reasonably possible; loss contingencies must be accrued if a loss is both "probable" and "reasonably estimable." In addition to the footnote disclosure required by the FASB, Generally Accepted Auditing Standards (GAAS) require that the auditor's report assess the probability that the resolution of a loss contingency will have a material effect on the financial statements. For financial statements issued after January 1989, an additional explanatory paragraph is required in the auditor's report if it is "probable" or "reasonably possible" that a material loss will occur (AICPA, 1988b, AU Sec. 508.25-26). For financial statements issued on or before January 1989, auditing standards required that a qualified ("subject to") opinion be issued if a loss contingency was expected to result in a material loss (AICPA, 1988a, AU Sec. 509.21-26).

Although the AICPA eliminated the "subject to qualification," the explanatory paragraph required under existing authoritative guidelines provides a "warning sign" to financial users about an uncertain outcome (Robertson, 1988). Specifically, a loss contingency deemed to be "probable," under both the old and new standards, requires a modification in the standard audit report that provides additional information about the contingency. Furthermore, a loss contingency judged to be "reasonably possible," under both the old and new guidelines, may or may not require a modified report. Thus, the different reporting should not vary the effect of such uncertainties on the market. Henceforth, both the explanatory paragraph and qualified opinion will be referred to as a modified audit report.

In spite of these requirements, there is an increasing concern with the reporting of potential commitments or contingencies that are not included in the primary financial statements for several reasons. First, there has been an explosive growth of newly developed financial instruments, such as financial guarantees. This growth motivated the FASB to adopt additional standards (SFAS 105 & 107) in an attempt to close the information gap associated with certain types of financial instruments. Various guarantees covered under these standards require contingency disclosure specified under SFAS #5, even if the outcome is only remotely possible. Second, the Securities and Exchange Commission (SEC) recently placed much more emphasis on the presentation of uncertainties in annual reports. SEC Financial Reporting Release #36 (1988), states that "any known demand, commitments, events or uncertainties. . .should be adequately disclosed in the Management Discussion and Analysis section" even though such disclosures may be provided in other sections of the SEC filing. Third, a general increase in litigation, guarantees, commitments and assessments have further added to the concern over contingency reporting (Accounting Trends and Techniques, 1991).

Research Objective

Although there is evidence of increasing concerns over contingency reporting, few studies examine the usefulness of loss contingency disclosures. Frost (1991) and Banks and Kinney (1982) investigate changes in the distribution of stock prices given loss contingency disclosures. Both studies indicate that loss contingency information is impounded in stock prices. However, neither study measures the effect of the contingency disclosures on the perceived riskiness of a firm. Only two studies, Alderman (1977b) and Finnerty and Oliver (1985), examine the relationship between risk and contingency disclosures. Alderman (1977b) found no significant increase in systematic risk after the issuance of a modified audit report. Alternatively, Finnerty and Oliver (1985) noted a significant increase in systematic risk for companies receiving modified reports. However, these studies do not allow a determination of the relationship between contingency disclosures and other market risk measures. Moreover, these risk studies focused on only the modified report while ignoring 1) footnote disclosures and 2) the effect of uncertainty disclosures on the firm's price of debt.

The purpose of this study is to determine whether loss contingency disclosures (e.g., financial footnote disclosures and modified audit reports) convey information that is useful in bond valuation. The study examines whether new bond issues reflect the inherent uncertainty related to loss contingencies and, investigates the conditions under which new issues reflect the additional risk.

Importance of the Problem

The results of this study provide information useful to accounting research. First, the study develops a theoretical relationship between bond valuation and loss contingency disclosures. Second, this theoretical relationship is tested to determine if the analytic relationship is empirically validated. The results indicate that loss contingencies are empirically related to bond valuation, and therefore useful in bond risk assessment. Specifically, the association between loss contingencies and bond risk premiums demonstrates that bond yields reflect the added risk inherent in contingencies.

Additionally, the findings have implications for accounting practice. The empirical association between contingencies and bond valuation indicate that the contingency reporting, required by SFAS No. 5 and GAAS, provides relevant information about the potential effect of contingencies on the firm's financial position. Specifically, the information contained in contingency footnotes and modified reports is useful in assessing bond price or bond risk. In this context, the study's findings may justify the requirements of SFAS and GAAS. Overall, this study adds to the existing body of knowledge concerning the determination of bond prices and suggests that further research on the effects of information on bond prices may prove fruitful.

The remainder of this study consists of six chapters. Chapter II provides a review of empirical studies related to the effects of loss contingency disclosures on security valuation. Chapter III develops the theoretical relationship between bond valuation and loss contingency disclosures and discusses the study's primary hypotheses. Chapter IV describes the empirical model, definition of variables and test statistics. Chapter V discusses the sample selection and data sources. The results of the study is presented and analyzed in Chapter VI. Finally, the studies primary conclusions and suggestions for future research are summarized in Chapter VII.

CHAPTER II

REVIEW OF LITERATURE

Introduction

In Statement of Financial Accounting Concepts No. 1, FASB states that investors and creditors require information about prospective returns and relating risks associated with investing and lending opportunities:

> Financial reporting should provide information to help present and potential investors and creditors in assessing the amount, timing, and uncertainty of prospective cash receipts from dividends or interest and the proceeds from the sale, redemption or maturity of securities or loans (par. 37).

While the FASB maintains that contingency disclosures provide information about firm specific risks, little evidence exists to indicate that disclosures are useful to investors and lenders. Prior research on the information content of loss contingencies focused exclusively on their impact on stock prices. This chapter reviews two classes of studies dealing with loss contingency disclosures: studies that examine the association between contingency disclosures and risk assessments and studies that investigate the relationship between contingency disclosures and stock-market returns/volume.

Stock Market Studies

Risk Assessment Studies

The first study that investigated the impact of loss contingency disclosures on risk assessment was conducted by Alderman (1977b). Alderman examined the information content of "subject to" opinions, by testing for shifts in market-assessed risk. Specifically, he used a time-series analysis to investigate changes in systematic and unsystematic risk from the three-year period preceding the first "subject to" opinion to the three-year period subsequent to the opinion. His findings indicate no significant changes in risk between the two time periods. Thus, Alderman asserts that uncertainty qualifications appear to have limited information content with respect to risk assessments, and therefore the "subject to" opinion should be eliminated. Thus, his findings are consistent with that recommended by the Cohen Commission. Subsequent to Alderman's study, SAS No. 58 (AICPA, 1988b) eliminated the "subject to" expression, although an explanatory paragraph still provides a "warning sign" to financial statement users (Robertson, 1988).

Although Alderman's findings support the elimination of the "subject to" qualification, the generalizability of the study is limited because of the relatively small sample (20 firms). Moreover, the findings are relevant only to investors' risk assessments, as the impact of such opinions on the risk assessments of creditors is not investigated. The research design is further limited because footnote disclosures regarding uncertainties and loss contingency predisclosures are not considered.

Finnerty and Oliver (1985) directed the only other study on the relationship between loss contingency disclosures and risk assessment. The study examined changes in systematic risk and found significant increases in security betas given modified reports. Like Alderman (1977b), their study is subject to methodological limitations. Finnerty and Oliver estimated betas over two 24-month periods. This estimation period may have resulted in a loss of power because of intervening events. Like Alderman (1977b), the research design is also limited in that uncertainty footnotes were ignored.

Returns and Volume Studies

Banks and Kinney (1982) also consider the association between stock market performance and audit opinion qualifications for initial uncertainties. However, their study extends the previous two studies by controlling for two relevant factors: 1) the sign of unexpected earnings and 2) footnote disclosure of uncertainties accompanied by an unqualified opinion. Examples of loss contingencies represented in the study include pending litigation, guarantees of indebtedness, and losses on discontinued operations. Banks and Kinney use paired differences cumulative abnormal return (CARS) as the dependent variable for the hypothesis test. Their findings provide weak evidence that the opinion is consistent with the information set used by the market; that is, the report may confirm the severity of the contingency. In this context, Banks and Kinney assert that a qualified audit report may have value and that it does not confuse the readers of the audit opinion. Users do not misinterpret or put unwarranted importance on "subject to" qualifications.

Banks and Kinney also find that risk-adjusted stock price reactions for 92 firms with new loss contingencies were significantly worse than the stock-price reactions for the 92 control portfolios matched by industry, time period, and sign of unexpected earnings. However, the firms were not partitioned by the amount of information provided in the disclosure (e.g., a dollar estimate of the loss contingency). A loss contingency disclosure may affect the value of a security differently depending on the expected magnitude of future losses.

Banks (1985) study was the first to evaluate investors' responses to the initial disclosure of events giving rise to a contingency. Banks investigates trading volume surrounding the initial announcement of loss contingencies in the Wall Street Journal (WSJ). In this context, Banks compares the firm's trading volume to ascertain whether the trading, resulting from annual earnings announcements, is less than the trading volume associated with loss contingency announcements. Twenty-seven firms from the Banks and Kinney (1982) study which had WSJ contingency disclosures preceding the annual report comprised the sample. Results demonstrate a significant mean level of abnormal volume for new contingency announcements in the WSJ. This study, then, suggests that investors revise their expectations quickly once aware of new contingencies. Because of the relatively small sample size, inferences are limited. Furthermore, Banks findings provide weak evidence (i.e., the cumulative mean volume residuals are only significant at the .10 level) that the initial announcement of loss contingencies results in a greater level of trading than that associated with the same firm's previous annual earnings announcement. However, the results provide preliminary evidence that expectations are revised rapidly (i.e., the day of the announcement). The findings also suggest that future investigations should consider the extent to which alternative sources of information, such as court filings, may be available and the basis (e.g., economic conditions) under which trading decisions are made.

Frost (1991) replicates and extends Banks and Kinney's (1982) study by investigating 72 firms that experienced new loss contingencies during the period 1976-1984. Frost's findings indicate that Banks and Kinney's results are robust to changes in experimental conditions, such as economic and auditing environments. Similar to the original study, Frost finds that firms with qualified opinions have more negative differences (CARS) than do firms with unqualified loss contingency opinions, but the differences are not statistically significant at conventional levels. Unlike the original study, however, cumulative abnormal differences are not lower for firms whose loss contingencies are predisclosed in the WSJ.

In summary, because of her focus on new reports, Frost does not consider the effect on stock returns of qualified audit opinions related to loss contingencies reported in prior financial statements. Moreover, Frost asserts that this approach limits the inferences that can be made because the resulting sample size of uncertainty qualified opinions is so small. Similar to the previous studies (i.e., Banks and Kinney, 1982; Alderman, 1977b), Frost does not consider the extent of disclosure of information about the loss contingency (e.g., estimated magnitude of the potential loss) or alternative predisclosure sources.

Extensions

The research reviewed above exhibited the following limitations.

First, each of the studies reviewed measures the impact of loss contingencies based on the stock-market returns or stock-market assessed risk. These studies examine the importance of contingency events only to equity investors; they neglect the importance or value of loss contingency reports to creditors. Second, although all studies examined stock-market return data, bond market data may be more useful. According to Reiter (1990), bond risk measures are useful in assessing changes in the variance of the distribution of expected cash flows (e.g., risk rather than return). This conclusion suggests that bond risk premiums are useful in assessing the effect of accounting information that may alter the perception of the riskiness of future cash flows. Third, the research reviewed does not directly consider the amount of information disclosed. The previous models that measure severity, such as levels of disclosures, could be improved by incorporating available information on the expected dollar magnitude of the potential loss (Dopuch, Holthausen, and Leftwich, 1987). Moreover, the risk studies did not investigate the effects of footnote contingency disclosures on risk. Fourth, the frequency of loss contingency disclosures is not considered. Market participants may perceive new loss contingency disclosures from a firm with numerous reported contingencies differently from the way they perceive disclosures from a firm with few previously reported contingencies.

Finally, both weak support for findings and mixed results were noted in the studies reviewed, particularly with respect to the usefulness of the qualified opinion. The research designs used in the studies may have contributed to this result in the following way. Notably, firms with loss contingencies may be inherently few in number;

however, all the above studies used firms selected only from Accounting Trends and Techniques, thus neglecting other data sources (e.g., NAARS) that might have increased the sample size and thereby the power of the tests.

In order to expand upon these previous investigations, this study will incorporate a larger sample size, establish the theoretical association between the severity of loss contingency disclosures and bond valuation, and develop a linkage between bond valuation and the number of loss contingency disclosures. Finally, as mentioned previously, GAAS post-SAS 58 requires an explanatory paragraph if it is expected that the resolution of a loss contingency will result in a material loss. To date, no other study has explicitly examined this new loss contingency disclosure, particularly within the context of its effect on bond valuation.

Summary

In summary, limited empirical evidence exists regarding the information content of loss contingency disclosures. Moreover, extant studies provide conflicting results on the impact of such disclosures on investment decisions.

This study expands upon previous studies by examining the relationship between bond risk and loss contingency disclosures. Moreover, it incorporates a larger sample size and a more explicit ranking of the severity of loss contingency disclosures. An examination of the effects of the frequency of loss contingency disclosures is also conducted. Details of the research methodology are presented in Chapter IV. The following chapter, Chapter III, develops the theoretical relationship between bond valuation and the severity and frequency of loss contingency disclosures.

CHAPTER III

THEORETICAL FRAMEWORK

Option Pricing Theory

Option pricing theory and contingent claims analysis (CCA) are combined below to derive continuous-time models that show a functional relationship between firm value, bond value, and loss contingencies. Specifically, option pricing theory and CCA posit that the value of a derivative security depends on the exogenously given value of an underlying asset or assets on which the option is written. For example, option pricing theory and CCA view non-dividend paying common stock (the derivative security) as a call option purchased from bondholders. That is, shareholders have the right to buy back firm assets (the underlying asset) from bondholders at maturity. The exercise price of the option corresponds to the bond's maturity value. Thus, the value of shareholder's equity at the maturity of the bond equals the value of the firm less the face value of the bond or zero, whichever is greater. Given the value of the firm and the value of equity, the value of debt is determinable (i.e., firm value less equity). This derived bond value is also a function of firm value, where the bond value at maturity is the lesser of firm value or bond maturity value. In this context, individual securities (e.g., bonds) can be viewed as contingent claims on firm value and priced accordingly. This example illustrates the arguments which are employed to value debt in a CCA framework. This research assumes that firm value is the underlying asset and that the bond is the derivative security.

Firm Value Model

The following analysis is based on several assumptions: 1) continuous trading, 2) perfect markets, and 3) a nonstocastic term structure (i.e., the riskless rate is constant throughout time). It is also assumed that firm value follows both a diffusion-type process (dz) and a "jump" stochastic process (dq). With respect to the former, a diffusion process implies that: 1) firm value changes continuously through time, 2) firm value always varies around the expected return, and 3) the resulting distribution is log-normal. In this context, the diffusion-type process describes the unanticipated change in firm value due to normal events, such as changes in the economy or other information that causes marginal changes in value. The "jump" stochastic process (dq) describes abnormal vibrations due to loss contingencies. The following differential equation depicts firm value, V, as mostly continuous except for deviations caused by loss contingency disclosures at discrete points in time.

$$dV = \alpha V dt + \sigma V dz + \xi dq \qquad (1)$$

where,

V = firm value; $f(t,q)$
α = instantaneous expected return on firm assets
dt = incremental change in time
σ^2 = instantaneous variance of return on firm assets
σ = instantaneous standard deviation of return on firm assets
dz = standard Gauss-Wiener process, (i.e. random-walk type process)
ξ = amount of change (jump) in firm value caused by loss contingency disclosure, where $\xi(V,t)$,

and

$q(t)$, represents the loss contingency described by a Poisson stochastic process. The level of change in the loss contingency (q) is $dq(t)$

where,

$$dq = \begin{cases} 1 & \text{with probability } \lambda dt \text{ that a loss contingency disclosure occurs} \\ 0 & \text{with probability } 1-\lambda dt \text{ that a loss contingency disclosure does not occur} \end{cases}$$

t = current time

and

λ = mean number of loss contingency disclosures per unit of time.

Essentially, equation (1) describes the instantaneous change in firm value, which drifts continuously through time, until information about an unfavorable loss contingency disclosure arrives. When such information is present, with probability, λdt, firm value changes by ξ. The firm's value is unaffected if there is no loss contingency disclosure ($dq = 0$). In order to model bond value, the loss contingency, ξdq, in terms of bond value, must be more clearly defined. This is accomplished in the next subsection.

Loss Contingency Effect

The derivation of the expected change in firm value resulting from a loss contingency disclosure assumes that the disclosure is a random event that can be characterized as unsystematic risk. Both Merton (1974) who modeled the jump process in the pricing of options, and Kalab et al. (1984), who modeled bankruptcy costs, treated unsystematic risk as a discontinuous stochastic variable, as presented below.

Let B equal bond value and assume that bond value is a function of firm value, B(V) where V(t,q). Also assume that B(•) is homogeneous of degree one, and let $\xi = \rho V$ with

ρ = a measure of severity of the loss contingency disclosure, and $0 \leq \rho \leq 1$.

Then the expected change in bond value, conditional on a loss contingency disclosure (i.e., $B(V - \xi) - B(V)$) is equal to

$$\lambda dt \dot{E}[B(V - \xi) - B(V)] + (1 - \lambda dt)[0].$$

Then,

$$B(V - \rho V) = B((1-\rho)V) = (1-\rho)B(V)^{1}$$

and

$$\lambda dt \dot{E}[(1-\rho)B - B] + (1-\lambda dt)[0]$$

which simplifies to

$$-\rho\lambda B dt \qquad (2)$$

which is the expected change in bond value given a loss contingency disclosure.

Bond Valuation Model

According to option pricing theory and contingent claims analysis (CCA), the derivation of bond value, B, is based on the firm-value process described in equation (1). Using equations (1) and (2) and Itôs lemma, we can show that the value of corporate debt is determined by the solution of the following differential equation (see Appendix A for derivation):

---

[1]Follows because B(•) is assumed to be homogeneous of degree one. Since firm value dependence is understood, the "V" as an argument of B is subsequently dropped.

$$\tfrac{1}{2}B_{VV}\sigma^2V^2 + r VB_V - r B - B_\tau - \rho\lambda B = 0 \quad (3)$$

where,

$\tau = T - t$, time-to-maturity, where T is the maturity date, and t is the current time.

Alternatively, the equation can be expressed as follows:

$$\tfrac{1}{2}B_{VV}\sigma^2V^2 + r VB_V - (r + \rho\lambda)B = B_\tau \quad (3.a)$$

Both equations (3) and (3.a) illustrate a functional relationship between loss contingency disclosure, firm value, and bond value. Specifically, bond value, in addition to being a function of firm value and time, is also a function of the loss contingency disclosure, the uncertainty component. Thus, the loss contingency disclosure theoretically affects the change in bond value. To summarize, equations (3) and (3.a) demonstrate that the theoretical components of bond value are time-to-maturity, the current market value of the firm, the riskless rate of return, the business or default risk of the firm, and the loss contingency, or $B = f(\tau, V, r, \sigma^2, \rho\lambda)$, respectively.

No closed-form solution exists for equations (3) and (3.a). However, various methods can be used to solve the equations, coupled with the appropriate initial and boundary conditions. These methods include quasilinear estimation or numerical techniques. This study uses a numerical procedure, explicit finite difference, to approximate the bond price equation. This method has been used by Brennan and Schwartz (1978) and others for similar contingent claims equations. The resulting finite difference equation, as derived in Appendix B, is

$$W_{i,j+1} = [1/(1 + (r + \rho\lambda)k)]\,[aW_{i-1,j} + bW_{i,j} + cW_{i+1,j}] \quad (4)$$

where,

$$W(Y,\tau) = W_{i,j+1}$$
W = bond value
Y = firm value
$a = [\frac{1}{2}(\sigma/h)^2 - \frac{1}{2}(r - \frac{1}{2}\sigma^2)/h]k$
$b = [1 - (\sigma/h)^2 k]$
$c = [\frac{1}{2}(\sigma/h)^2 + \frac{1}{2}(r - \frac{1}{2}\sigma^2)/h]k$
$i = 1,2,3,\ldots, n$
$j = 1,2,3,\ldots, m$
$k = dt$
h = change in firm value

Equation (4) represents the current value of a bond at a point in time $j + 1$. Thus, the equation solves for the expected present value, $W_{i,j+1}$ in terms of the future value, $W_{i,j}$. Furthermore, the additional cost of uncertainty is represented in the expression $(r + \rho\lambda)k)$; the riskless rate will be increased by $\rho\lambda$ if a loss contingency disclosure is present. This increase implies that the bond sells for a lower price and for a greater return to compensate for the added risk. Specifically, because the loss contingency disclosure affects bond value, an investor/creditor will demand a greater return because of the uncertainty with respect to the settlement of the loss contingency described in the disclosure.

Risk Premium

The risk premium is defined as the rate of return demanded above the risk free rate (i.e., the difference between the corporate rate and the riskless rate). As mentioned previously, the presence of a loss contingency increases the riskless rate. Therefore, a risk premium is evident. This relationship between the risk premium and loss contingency is further demonstrated below using equation (4).

Let R equal the rate of return on the corporate bond and r equal the riskfree rate of return; then

$$R = [aW_{i-1,j} + bW_{i,j} + cW_{i+1,j}]/W_{i,j+1} - 1 \qquad (5)$$

Substituting the r.h.s. of equation (4) into equation (5) for $W_{i,j+1}$, and canceling terms yields:

$$R = (1 + r + \rho\lambda)k \left[\frac{(1 + r + \rho\lambda)k - 1)}{(1 + r + \rho\lambda)k}\right]$$

$$R = (1 + (r + \rho\lambda)k - 1 = rk + \rho\lambda k$$

Thus, the risk premium is

$$R - r(k) = \rho\lambda(k). \qquad (6)$$

This shows that, while holding all other factors constant, the difference in yield (i.e., the yield premium) is augmented by the presence of the loss contingency disclosure.

The log transformation of equation (6) provides the following additive relationship:

$$\text{Ln}\ ((R - r(k)) = \ln\rho + \ln\lambda + \ln\ (k). \qquad (7)$$

This transformation is useful for empirical testing because it allows ρ and λ to enter as separate variables.

Expanded Bond Valuation Model

The models derived above (equations (3) and (3.a)) represent basic cases. However, to obtain greater generalizability, the models may be expanded by including other components. For instance, in equation (8) below, dividend and interest payments are added in order to incorporate dividend paying stock and coupon bonds.

Although, the time-to-maturity, τ, in the theoretical equation, represents an issue specific trait, there are other provisions in the indenture that affect the value of a particular issue (Merton, 1974 and

Fisher, 1959). Thus, the expanded equation includes another issue trait, sinking fund payments. Other components of issue traits include subordinate status and callability. In an attempt to keep the equation tractable, these two traits are not included in equation (8). The expanded model is

$$\tfrac{1}{2}B_{VV}\sigma^2V^2 + [rV - C - SF - D]B_V - (r + \rho\lambda)B = B_\tau \tag{8}$$

where,

C = coupon payment to bondholders
SF = sinking fund
D = dividend payment

In this context, equation (8) demonstrates, as the basic case does, that the theoretical elements of bond value include various bond indenture provisions (e.g., issue traits), default risk (e.g., σ^2), the interest rate, and loss contingencies. The model could be solved employing the same procedure used for the more basic case. If the finite difference method were used to solve the complex equation (8), similar results would be obtained. That is, the riskless rate will be augmented by $\rho\lambda$ if a loss contingency disclosure is present.

Statement of Hypotheses

The theoretical framework predicts that bond prices will be associated with loss contingency disclosures. Specifically, equation (3.a) and (3.b), relates contingency disclosures to bond valuation, while equation (4) demonstrates that loss contingency disclosures increase the level of uncertainty or risk premium associated with a bond. The latter confirms that bond valuation can be empirically measured in terms of a risk premium.

Equation (6), further delineated the theoretical relationship between the level or severity of loss contingency disclosures and bond risk premiums. Hypothesis one is used to test this proposition.

H_{01}: Bond risk premiums are not differentially associated with the severity of loss contingency disclosures.

The severity index, ρ in the theoretical model, represents the expected severity of the loss contingency as conveyed by the disclosure. Specifically, if rejected the coefficient will be significant and positive. The rejection of hypothesis one will provide evidence that the market weighs loss contingency disclosures according to the severity of the disclosure. Thus, firms' bond premiums should vary directly with the level or severity of the loss contingency disclosures. Since it is expected that an additional bond risk premium will be assessed because of the increase in risk, rejection of H_{01} will be consistent with loss contingency disclosures providing useful information for risk assessment.

The second hypothesis tests whether the frequency of the loss contingency disclosures is related to risk premiums. The market may perceive the risk associated with contingencies to be greater for firms with numerous reported loss contingency disclosures. Thus, the bond market may assess a higher risk premium for firms with a higher frequency of loss contingency disclosures. The hypothesis two, stated in the null form, is

H_{02}: Bond risk premiums are not associated with the number of loss contingency disclosures.

Rejecting hypothesis two is consistent with the proposition that the number of loss contingency occurrences, λ, is directly related to the risk premium associated with a bond. If rejected, the coefficient on the frequency variable will be positive and significant. Thus, rejection of H_{02}, will provide further support for the proposition that loss contingency disclosures are used in bond risk assessment.

CHAPTER IV

METHODOLOGY

Introduction

This research involves a cross-sectional study of new bond issues. The components of bond value (e.g., issue traits, default risk or business risk, the interest rate, and loss contingency disclosures) described in the theoretical models are represented by various proxy variables in an Ordinary Least Squares (OLS) regression model. The linear regression model is often employed to investigate issues in accounting and is specifically applied to questions about the effects of accounting information on bond risk premiums.

The first section of this chapter describes the development of the empirical model. In this section, the dependent variable (risk premium) is defined. Also, each finance and bond issue variable and its relationship with the dependent variable is discussed. The next section of the chapter delineates the development of the loss contingency variables (i.e., severity index and frequency). The final section describes the statistics used to test the hypotheses.

Risk-Premium Regression Model

The theoretical models, equations (3, 3.a and 8), associate bond valuation with issue traits, the market value of the firm, the business or default risk of the firm, riskless rate of return, and loss contingency disclosures, or $B = f(\tau, V, \sigma^2, r, \rho\lambda)$, respectively. These elements of bond value are represented by various proxy variables which are defined in Table I. The variables defined in Table I, can be summarized in the following regression equation (9):

$$Y_p = \beta_0 + \beta_1(SUB) + \beta_2(SINK) + \beta_3(MAT) + \beta_4(CALL) + \beta_5(SIG) + \beta_6(DE) + \beta_7(SIZE) + \beta_8(RATE) + \beta_9(FREQ) + \beta_{10}(LCIDEX) + \varepsilon \quad (9)$$

where variables were defined previously in Table I, and
ε = error term, assumed to be distributed with a $\mu = 0$ and variance σ^2.

This equation (9) is henceforth referred to as the Risk-Premium Model #1, or the unrestricted model.

Equation (7) implies that the two contingency variables (frequency and severity) are separable and therefore may be included separately in a regression model. Although a log-transformation was used to separate the variables, a normality test indicates that the variables do not follow a log-normal distribution. Furthermore, in order to assess the information content of loss contingencies over the other explanatory variables the contingency variables were further separated by various restrictions (i.e, $\rho \neq 0$ and $\lambda = 0$, or $\lambda \neq 0$ and $\rho = 0$, or $\rho = 0$ and $\lambda = 0$)., Accordingly, the version of equation (9) that excludes the loss contingencies is referred to as the Risk-Premium Model #2, or the restricted model. Model #2 is

$$Y_p = \beta_0 + \beta_1(SUB) + \beta_2(SINK) + \beta_3(MAT) + \beta_4(CALL) + \beta_5(SIG) + \beta_6(DE) + \beta_7(SIZE) + \beta_8(RATE) + \varepsilon \quad (10)$$

where variables were defined in Table I, and ε = error term.

TABLE I

DEFINITION OF MODEL VARIABLES

Theoretical Equation	Component	Theoretical Model Name	Empirical Definition	Sign	Premium Model Name
3,3.a,4,8	Bond Value	B ; $W_{i,j+1}$	Bond Risk Premium		Y_p
6	Risk Premium	R − r(k)	Bond Risk Premium		Y_p
8	Issue Trait	Subordinate Status*	Senority Status	+	SUB
8	Issue Trait	Sinking Fund Payments	Sinking Fund	−	SINK
3,3.a,8	Issue Trait	τ	Maturity of Bond	+	MAT
8	Issue Trait	Callability*	Call Status	−	CALL
3,3.a,8	Default Risk	V,σ^2	Standard Deviation of Firm Value	+	SIG
3,3.a,8	Default Risk	V,σ^2	Debt to Equity	+	DE
3,3.a,8	Default Risk	V,σ^2	Total Assets	−	SIZE
3,3.a,8	Riskless Rate	$\underset{\sim}{r}$	Treasury Yield	+	RATE
2,3,3.a,4,6,7,8	Loss Contingency	ρ	Weighted Severity Index	+	LCIDEX
2.3,3.a,4,6,7,8	Loss Contingency	λ	Mean # of Disclosures	+	FREQ

*In order to keep the equation tractable, Callability and Subordinate Status were not included.

The unrestricted and restricted models are compared to determine the incremental explanatory power attributed to the loss contingency model over a model without a loss contingency component. Chapter VI describes the results of this comparison.

Measurement and Scaling of Variables

This section of the chapter addresses the definition and measurement of variables included in the empirical models discussed above. The explanatory variables and their relationship to the dependent variable, risk premium, is also presented.

Yield Premium Variable - Y_p

Equation 4 indicates that a risk component is added to the risk factor, (1+r), when a loss contingency is present. The degree of added risk is determined by incorporating the expected effect of the loss contingency on bond value, ρ, and the mean number of loss contingency disclosures, λ. Thus, the effect on bond prices caused by the components, ρ and λ, is measurable in terms of a bond yield premium. Typically, researchers (Reiter, 1991; Barrett et al., 1986a; Adel-khalik, 1981) use yield or risk premium models to investigate the effects of accounting information on bond prices. Therefore, this study empirically measures the effect of loss contingencies on bond price as the difference between the bond yield rate and the riskless yield rate. In this context, the measured effect on bond prices caused by loss contingency disclosures and other risk components is defined by the following equation:

$$Y_p = (Y_b - Y_r) \tag{11}$$

where

Y_p = Yield premium, dependent variable
Y_b = Offering yield (i.e.yield offered to investor)
Y_r = Yield of U. S. Treasury bond

Default-Risk Variables

In previous bond research, the market value of the firm or default risk is proxied by a combination of several variables (e.g., coefficient of variation of return on equity, common stock beta, debt to equity ratio, and firm size). Only Ogden (1987) and Jones et al. (1984) demonstrate that the standard deviation of return on firm value (σ), used as the sole proxy for default risk, is useful in explaining bond risk. Moreover, Ogden (1987) showed that the explanatory power of his bond risk model was significantly improved once firm size and the leverage ratio were added. Following Ogden, this study incorporates the standard deviation of return on firm value, firm size and leverage ratio in the risk premium models. The derivation of σ and the relationship between debt ratio and firm size variables are described in the foregoing subsection.

Estimation of σ^2

The standard deviation of firm value was estimated for each firm using an iterative process. In addition, option pricing theory was employed to develop the estimated σ. Following option pricing theory, it was assumed that equity adheres to both a diffusion and jump stochastic-type process and that the dynamics of these processes can be described by a differential equation. Furthermore, according to option pricing theory, equity can be considered a call option on firm value, thus the Black-Scholes model (1973)[2] was used to value equity. Given that the return on firm value and the return on equity are correlated, the latter was used to model the return on firm value or, $\sigma_s = \sigma V F_V / F$. The definitions and estimation of the equation's variables and the iterative process follows below.

Estimation Formula for σ^2. The relationship of the market value of equity can be described by the stochastic differential equation,

$$dS = \alpha_s S dt + \sigma_s S dz_s + \xi_s dq_s \qquad (12)$$

where

α_s is the expected rate of return on equity
σ_s is the standard deviation of return on equity
ξ_s is the amount of change in equity value caused by a loss contingency disclosure
dq is the level of change in the loss contingency,

and

dz is the standard Gauss-Wiener process.

According to option pricing theory, the market value of equity (common stock), S, is determined by the underlying value of the firm and time, or $S = F(V,\tau)$. Furthermore, Itôs lemma shows a functional relationship between α_s, σ_s, dz_s and dq_s and the comparable variables in equation (1) α, σ, dz and dq, such that,

$$dS = dF(V,\tau) = F_V dV + \tfrac{1}{2} F_{VV} \sigma^2 V^2 - F_\tau dt \qquad (13)$$

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[2]The Black-Scholes model is

$E = N(d1)V - Be^{-rt}N(d2)$
$d1 = \ln(V/B) + [r + \sigma^2/2]t/\sigma(\text{sqrt})t$
$d2 = d1 - \sigma(\text{sqrt})t$,

where variables are defined above.

The substitution of equation (1), where ξdq is defined as $-\rho\lambda F dt$ into equation (13), yields the instantaneous change in equity value, where subscripts are partial derivatives:

$$dS = [F_V(\alpha V) + \tfrac{1}{2}F_{VV}\sigma^2V^2 - F_\tau - \rho\lambda F]dt + F_V\sigma V dz.^3 \qquad (14)$$

Following Merton (1974), terms are compared in the market-value of equity equation (12) and equation (14). Using one of these equalities,[4] the instantaneous standard deviation of levered equity σ_s can be derived as,

$$\sigma_s S = \sigma_s F \equiv F_V \sigma V$$

$$\sigma_s = \sigma V F_V / F \qquad (15)$$

where

F_V = partial derivative of F with respect to firm value, V
F = value of common stock
σ_s = standard deviation of levered equity

and

σ = standard deviation of return on firm value.

The standard deviation of return on firm value and the return on equity are instantaneously perfectly correlated. This follows implicitly from the equalities of $dz_s \equiv dz$ and $dq_s \equiv dq$. Since the standard deviation of return on firm value and the return on common stock are correlated, equation (15) was used to iteratively estimate σ. In order to calculate σ, the other parameters in equation (15) were estimated.

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[3]Notably, the derivation of equation (14) parallels the derivation of the change in bond value equation (A.11; Appendix A) with respect to the assumption of the underlying security (firm value) and the rules of stochastic calculus used. It differs with respect to the derivative security (common stock).

[4]The other equalities are:

$$\alpha_s S = \alpha_s F \equiv F_V(\alpha V) + \tfrac{1}{2}F_{VV}\sigma^2V^2 - F_\tau - \rho\lambda F$$
$$dz_s \equiv dz$$
and $$dq_s \equiv dq,$$

where variables were previously described above.

Estimation of Parameters. Firm value, V, included three basic components: 1) market value of equity, F, 2) market value of traded long-term debt, and 3) market value of nontraded long-term debt. Each of these components is calculated as described below.

First, the market value of common stock equity, (F, in equation (15)), is estimated one month before the bond issue, by multiplying total common stock outstanding by market price. Second, the total market value of traded long-term debt is calculated, for the same period, by multiplying the firm's outstanding par-value of debt by its current price. Third, nontraded debt was calculated as total assets less stockholders' equity and outstanding par-value of long-term debt. Furthermore, using the assumption that the ratio of book to market is the same for both traded and nontraded debt, the market value of nontraded debt was estimated. However, for firm's without traded debt (e.g., 23 bond issues), the market value of nontraded debt was represented by the year-end book value of debt.

Finally, the standard deviation of equity, σ_s, was estimated as the annualized standard deviation of returns on common equity for 24 months before the bond issue. Accordingly, all of the parameters in equation (15) were estimated, except for F_V, the partial derivative of equity value with respect to firm value and return on firm value, σ. Therefore, an initial value was assigned to F_V in order to obtain a seed value for σ.

Iterative Process. The iterative process was executed according to the following three steps:

In the first step, the initial estimate of F_v was derived by assuming that F_v (in equation (15)) equaled 1. In step two, the estimate of σ from the previous step was used to obtain a revised estimate of F_v. Components of the Black-Scholes model were used to obtain this revised estimate of F_v, by calculating

$$d1 = \ln(V/B) + [r + \sigma^2/2]t/\sigma(\text{sqrt})t \quad (16)$$

$$F_v \equiv N(d1) \quad (17)$$

where

B = par value of the firm's long-term debt
r = continuous riskless rate, (LN(1+r/100)
σ = estimated standard deviation of return on firm value
t = weighted average of maturity of the firm's long-term debt,

and

N(d1) = cumulative normal probability of d1.

In the third step, the estimate of F_v from step two, was substituted into equation (15) to derive a revised estimate of σ. This revised estimate of σ, and the σ from step two were compared: if the difference between the σ's, was less than .00001, the process, (steps 2 and 3), was repeated until the standard deviations converged. This standard deviation of return on firm value is represented in the model as SIG.

Debt-to-Equity Ratio and Size

The debt-to-equity ratio and total assets were also used to proxy for default risk in the regression models. In prior studies these two variables were significant determinants of new bond yields (Fisher, 1959; Abdel-khalik et al., 1981; and Ogden, 1987). The level of the debt ratio may affect the yield rate. That is, the larger the ratio, the more likely the firm will have difficulty in obtaining debt and consequently the higher the cost of debt (Prasky and Chandy, 1991). In this context, the bonds of firms with a higher debt-to-equity ratio are riskier and lenders will likely demand a higher premium of return. The debt/equity ratio variable was defined as

$$DE = \text{Par Value of Debt/Market Value of Equity} \qquad (18)$$

With respect to the third proxy for default risk, firm size, it is likely that the larger the firm, the less likely the default occurrence of bonds (Fisher, 1959). Because a larger firm may be perceived as less risky vis-a-vis a smaller firm, the cost of its debt may be lower than that of a smaller firm within the same industry. Accordingly, a size variable (SIZE) is incorporated into the model, where SIZE is equal to total firm assets.

Issue Characteristic Variables

Issue characteristics represent several traits that are uniquely related to a specific bond issue. Research has consistently demonstrated that these traits impact yield premiums and bond prices. The variables representing these characteristics are subordinate status, sinking fund, term to maturity and callability.

Subordinate Status. The empirical model includes a variable that reflects the seniority status of the bond. It is suggested that the lower the status of the bond, the more at risk are bondholders' payoffs in the event of default or firm liquidation. In this context, the subordinate status is directly related to risk premiums, suggesting that senior debt should have a higher price than subordinate debt (Black and Cox, 1976). The dummy variable included to reflect the seniority status of the bond was coded as follows:

SUB = 0 = Senior

SUB = 1 = Subordinate

Sinking Fund, Maturity and Call. The sinking fund component in the theoretical model is proxied by the presence of sinking fund convenants. The presence of sinking fund covenants has been shown to be associated with lower bond yields (Roberts and Viscione, 1984). This effect may be explained by the fact that the bondholders believe that the firm's initiative in entering into complex fund agreements for the borrower's security is a positive quality of the issuer (Ho and Singer, 1984). The presence of a sinking fund is represented, in the empirical model, by a dummy variable SINK.

The maturity of the bond has also been demonstrated to be directly related to risk premiums because of the increased exposure to interest rate risk the longer the bond is outstanding (Cook and Hendershott, 1978). Thus, the variable MAT represents the term structure of the bond.

The presence of call provisions is expected to affect yields. In periods of high market interest rates (e.g., 1983-1985) call risk may be an important factor in bond prices, since investors may pay an added premium for call protection in order to retain the high yields, especially when refinancing at lower interest rates at a future point in time appears likely. The presence of a call provision, in the model, is measured by a dummy variable, CALL, where a callable bond is coded one.

Interest Rate

The riskless rate of return in the analytical models (3, 3.a and 8) is shown to be related to yield premiums. Treasury yield levels (i.e., riskless rate) vary directly with risk yield spreads. Risk yield spreads tend to widen in recessionary periods and narrow during economic expansion (Van Horne, 1990). This volatility of interest rates is an important concern, since the bond sample spans several years. Therefore, the level (i.e., average) of treasury yields, (RATE), is used to control for the volatility of interest rates.

Loss Contingency Test Measures

Severity Measure

The loss contingency effect is measured on an ordinal scale, and is a proxy for ρ in the theoretical model. The scale reflects the expected weight (severity) of the loss contingency as conveyed by the disclosure. Accordingly, a financial footnote disclosure, which conveys that there will be little, if any, material effect on firm value by the resolution of the loss contingency, is expected to have a limited impact on bond value. In contrast, an auditor's report, which conveys that a loss contingency is reasonably possible or probable and will significantly affect firm value, is expected to have the greatest impact on bond value. Finally, including the dollar amount of the expected loss in the disclosure conveys a certainty component with respect to the expected effects on firm value. This may imply that the more disclosure the more severe the expected effect on firm value. On the other hand, if a dollar amount is disclosed, it may reveal that the contingency is immaterial, even though the uncertainty of the eventual outcome is unchanged. A definition of materiality is, therefore, necessary in order to scale its expected impact on bond value. Chewning, Pany and Wheeler (1989) and Holstrum and Messier (1982) reviewed prior research on materiality and found that an item's percentage effect on net income is the most significant component in materiality decisions. In this context, both indicated that items that affect net income more than 10 percent are deemed material but events less than five percent of net income are considered immaterial. Morris and Nichols (1988), in their examination of interest-capitalization consistency exceptions, concluded that items affecting approximately eight percent or less of net income were classified as immaterial.

A contingency, in this study, was classified as materially adverse if the dollar magnitude required or expected to be paid was greater than nine percent of net income. The materiality assessment was made using the net income (loss) for the year in which the contingency was disclosed. The absolute value of net income (loss) was used since several sample companies reported a net loss. This method is consistent with previous studies (Chewning, Pany and Wheeler, 1989; and Morris and Nichols, 1988).

A contingency was deemed immaterial, with respect to a particular index level, if 1) the disclosure mentioned that the uncertainty was expected to be settled without a material or adverse affect or 2) the dollar magnitude, if disclosed, was less than or equal to nine percent of the firm's net income (or the absolute value of the firm's net loss). Each footnote and modified report in each firm's annual report was coded according to the scale below. After this initial coding, the number of codes was added for each firm's report. For example, a firm with two severity levels equal to four and one severity level equal to one, aggregated to a (weighted) Severity Index of nine. The scale is referred to as the Severity Index Scale, where,

S = 1 = immaterial financial footnote disclosure

S = 2 = material footnote disclosure: adverse reference or material $ amount

S = 3 = immaterial footnote disclosure and audit report

S = 4 = material footnote disclosure and audit report: adverse reference or material $ amount

The variable is specified as LCIDEX. This variable is used to proxy for the (weighted) Severity Index in the regression equation. The descriptive statistics for this parameter are presented in Appendix E.

Frequency Variable

A frequency variable (FREQ) was included in the model to test the theoretical association between bond risk and the frequency of loss contingency disclosures. The mean number of loss contingency disclosures per unit of time was defined as the total number of loss contingency occurrences within the study period divided by the study period. For a given issue, each firm's financial statements were examined for the years 1983-1990 to determine if a contingency disclosure was present in any year other than the year already selected. An occurrence is defined according to the following criteria. If the financial statement contained either 1) several disclosures, 2) a modified report, or 3) a material disclosure (as defined above) then one occurrence was recorded for the year. Otherwise, a disclosure was deemed immaterial and coded zero if a disclosure provided no specific details and stated that the expected impact was immaterial. Appendix E lists the descriptive statistics for this variable.

Statistical Tests for Models and Variables

To provide evidence of the usefulness of contingency disclosures in assessing bond risk premium, the T-statistic was used to measure the significance of individual variables, while the F-test was selected to examine the incremental explanatory power.

Significance Tests Statistics

The two hypotheses stated in Chapter III, were tested by means of T and F statistics to determine if LCIDEX and FREQ are significantly different from zero. A significant T-test and F-test would indicate that the null hypotheses, H_{01} and/or H_{02}, is rejected. Each of the other explanatory variables were tested using the T-statistic.

The loss contingency coefficients were restricted (excluded) in Risk-Premium Model #2 to test the incremental explanatory power attributable to the loss contingency variables. The increased power attributed to severity index and/or frequency is tested by comparing the sums of squared residuals (SSR), from both models. $SSR_{\text{Risk-Premium Model, unrestricted}}$ is expected to be smaller than $SSR_{\text{Risk-Premium Model, restricted}}$. The statistic used to test the decrease in SSR and thus the increased explanatory power for the addition of loss contingency variables is

$$F^* = \frac{(SSR_{\text{model,restricted}} - SSR_{\text{model,unrestricted}}) \; / \; r}{SSR_{\text{model,unrestricted}} / (n-k-1)} \qquad (19)$$

The statistic has an F distribution where $SSR_{\text{Risk-Premium Model, unrestricted}}$ and $SSR_{\text{Risk-Premium Model,restricted}}$ are the sum of squared errors for the respective models. The degrees of freedom are r, which equals the number of coefficient restrictions; k, the number of parameters in Model #2; and n, the total number of observations. Where the null hypothesis, which states that contingencies have no effect on risk-premium in this model, is rejected if $F^{*}_{(r,n-k-1)} \geq F^{c}$; where F^{c} is the critical value with a selected significance level (Mirer, 1988).

CHAPTER V

SAMPLE AND DATA SOURCES

Sample Group

Sample companies were selected from the 1992 NAARS (National Automated Accounting Research System) data base. Initially, all firms with loss contingency disclosures appearing in financial statements from years ending 1983-1990 were selected. The loss contingencies examined included 1) pending litigation(s), 2) pending losses on discontinued operations, 3) guarantees of indebtedness, 4) assessments, 5) government regulations, 6) sale of receivables with recourse, 7) going concern, and 8) asset realization/valuation. Contingency disclosures were obtained by searching the footnote and report information in NAARS using the above contingencies plus the following terms: lawsuit, defendant, complaint, damages, bankruptcy, writedown, realize, and revalue. Firms initially selected in this step were retained if the following criteria were meet:

1>. Available financial data in COMPUSTAT and CRISP data bases,

2>. December 31, year-end, and

3>. Industry code (SIC) less than 5999.

The calendar year-end criteria was imposed to ensure that the timing of financial information disclosures would be approximately the same across firms. The SIC criterion was applied to provide an adequate sample size and to ensure relatively homogenous groups of firms: industrials and public utilities.

With respect to the composition of firms, public utility companies comprised 58 percent of the total firm sample and approximately 46 percent of the total bond issues. Industrial firms made up 42 percent of the firm sample, and 53.76 percent of the total bond issues. The number of company bond issues, the company name, and the year of the loss contingency disclosure are presented in Appendix D. Appendix D also contains the firms' descriptive financial statistics.

Bond Sample

The sample consists of new bond issues. New bond issues were used instead of seasoned bonds because risk premiums are modeled more accurately with new issues. It is more difficult to gather accurate price quotes for seasoned bonds because very few corporate bonds are regularly traded.

Bond information was collected if one or more bonds were issued within one year of the firm's loss contingency disclosure. Only those bond issued between February 24 and December 31, were selected. The February bond issue criteria were imposed to ensure that the financial information/disclosures would be available to market participants. In addition, for companies with more than one bond issue per year, only the bond issue closest to the February 24 date was kept. Also zero coupon, government, convertible, foreign, and variable-coupon-rate bonds were excluded. Table II presents the bond research sample total and the resulting attrition, while Appendix D contains the descriptive bond statistics.

Data Sources

Data from the 1992 COMPUSTAT annual industrial file were used to select calendar year-end financial data for the year-end before the bond issue, while CRISP (Center for Research in Security Prices, 1992) monthly tapes were used to select common stock data. The financial and equity data and their sources are further described in Appendix C.

Bond data were recorded if one or more bonds were issued within one year of the firm's loss contingency disclosure. The offering date, offering yield, current price of outstanding debt, par value of outstanding debt, and indenture terms (call, maturity and sinking-fund status) were collected manually from either Moody's Bond Record or the Public Utilities Manual. Treasury yields were acquired manually from the Wall Street Journal (WSJ). If the WSJ did not reference a yield identical to the observed bond with respect to maturity and coupon, then the yield was collected from Moody's Bond Survey. The previous day's treasury closing-yield was matched with the offering yield of the new bond issue. Research indicates that this appropriately depicts the manner by which investment institutions set offering yields.

TABLE II

NUMBER OF BONDS IN LOSS CONTINGENCY SAMPLE

	Bonds
Total industrial and utility bonds	1056
Criteria for exclusion:	
Unavailable data on COMPUSTAT or CRISP	(327)
Missing Bond Data	(25)
Extreme Discounts or Premiums (outliers)	(17)
More than one bond issue for firm in LC Year or duplicate bond issues for firm	(421)
Total bond sample	266

CHAPTER VI

RESULTS

Introduction

The relationship between bond valuation and loss contingency disclosures was the focus of this study. The two related hypotheses presented in Chapter III were tested, respectively, based on the foregoing criteria:

A>. Whether the severity index (LCIDEX) coefficient was significantly different from zero and positive; and

B>. Whether the frequency (FREQ) was significantly different from zero and positive.

In addition, an evaluation was made to determine whether the increased explanatory power of the unrestricted Risk-Premium Model was significantly different from the empirical model that excluded contingency variables.

The presentation of the results begins with the estimation of the regression models. In this section, the test for the relationship between bond valuation and loss contingency variables is evaluated. The final section describes the model specification tests.

Estimation Results

The significance levels for the FREQ and LCIDEX coefficients were evaluated in order to assess the relationship between bond valuation and loss contingencies. Furthermore, a restricted regression equation was estimated that excluded contingency disclosures. The severity index and frequency of disclosure variables were entered separately in the regression model to evaluate the incremental explanatory power associated with each variable.

The results of estimation of the risk-premium models are summarized in Tables III through VI. The R^2 for the restricted model is .621. When the frequency variable (FREQ) is added to the model the R^2 increases to .631 which is significant at the .05 level [F^* (6.35) > F^c (3.84)]. Moreover, the coefficient on FREQ is 0.456034, yielding a t-statistic of 2.520 which is significant at the 0.0123 level. Thus, consistent with expectations, the effect of FREQ is positive and significant.

The sole inclusion of the severity index (LCIDEX) into the unrestricted model yields similar results. When the frequency variable (LCIDEX) is added to the model the R^2 increases to .632 which is significant at the .05 level [F^* (7.05) > F^c (3.84)].[5] Moreover, the coefficient on LCIDEX is 0.047135. The related t-statistic is 2.66 which is significant at the 0.0084 level. Thus the effect of LCIDEX is positive and significant which is also consistent with expectations.

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[5]Increased explanatory power for LCIDEX was also strongly significant at a .01 significance level.

TABLE III

ESTIMATION RESULTS
Dependent Variable: Y_p, N = 266

RISK-PREMIUM MODEL #1: Restricted
(Excludes FREQ and LCIDEX)

Variable	β_i	Estimate of Coefficient	T for HO: $\beta_i = 0$	PR > |T|	Standard Error of Estimate
Intercept	β_0	1.848960	3.237	0.0014	0.571116
Sub	β_1	2.110918	11.896	0.0001	0.177447
Sink	β_2	-0.290130	-2.291	0.0228	0.126621
Mat	β_3	0.016016	3.086	0.0023	0.005190
Call	β_4	-0.052646	-0.500	0.6172	0.105197
Sig	β_5	2.311146	2.664	0.0082	0.867439
DE	β_6	0.397986	9.784	0.0001	0.040678
Size	β_7	-1.8653E-5	-5.669	0.0001	3.2900E-6
Rate	β_8	-0.158018	-2.694	0.0075	0.058654
R^2		62.21			
Adj.R^2		61.03			

TABLE IV

ESTIMATION RESULTS
Dependent Variable: Y_p, N = 266

RISK-PREMIUM MODEL: Unrestricted
(Includes FREQ)

Variable	β_i	Estimate of Coefficient	T for HO: $\beta_i = 0$	PR > |T|	Standard Error of Estimate
Intercept	β_0	1.344438	2.242	0.0258	0.599656
Sub	β_1	2.151960	12.201	0.0001	0.176381
Sink	β_2	-0.264643	-2.105	0.0363	0.125730
Mat	β_3	0.016795	3.263	0.0013	0.005147
Call	β_4	-0.016709	-0.159	0.8738	0.105091
Sig	β_5	3.142832	3.417	0.0007	0.919775
DE	β_6	0.404009	10.017	0.0001	0.040331
Size	β_7	-1.9297E-5	-5.908	0.0001	3.2700E-6
Rate	β_8	-0.152495	-2.625	0.0092	0.058093
FREQ	β_9	0.456034	2.520	0.0123a	0.180934
R^2		63.12			
Adj.R^2		61.83			
F-Statistic		6.35			

[a]Significant at 0.05 level.

*F-statistic was derived from the linear tests of differential explanatory power of the unrestricted model over the restricted model; where the critical F-statistic, at a significance level of 0.05, is approximately 3.84, with freedom of (1,256).

TABLE V

ESTIMATION RESULTS
Dependent Variable: Y_p, N = 266

RISK-PREMIUM MODEL: Unrestricted
(Includes LCIDEX)

Variable	β_i	Estimate of Coefficient	T for HO: $\beta_i = 0$	PR > |T|	Standard Error of Estimate
Intercept	β_0	1.569930	2.734	0.0067	0.574210
Sub	β_1	2.134508	12.154	0.0001	0.175619
Sink	β_2	-0.283925	-2.268	0.0242	0.125179
Mat	β_3	0.015511	3.021	0.0028	0.005134
Call	β_4	-0.030787	-0.295	0.7681	0.104307
Sig	β_5	2.963403	3.323	0.0010	0.891909
DE	β_6	0.384811	9.499	0.0001	0.040512
Size	β_7	-1.7312E-5	-5.260	0.0001	3.2900E-6
Rate	β_8	-0.154754	-2.669	0.0081	0.057988
LCIDEX	β_{10}	0.047135	2.655	0.0084a	0.017753
R^2		63.22			
Adj.R^2		61.93			
F-Statistic		7.05			

[a]Significant at 0.05 level.

*F-statistic was derived from the linear tests of differential explanatory power of the unrestricted model over the restricted model; where the critical F-statistic, at a significance level of 0.05, is approximately 3.84, with freedom of (1,256).

Finally, the inclusion of both FREQ and LCIDEX in the restricted model results in an increased R^2 of .64. The results, F^* (4.71) > F^c (4.61), indicate that 1) the model is significantly different from the restricted model at the .01 level, and 2) the contingency disclosures explain a significant amount of variation in risk premiums. The coefficient on LCIDEX was 0.034106 yielding a t-statistic of 1.74 which is significant at the 0.084 level. On the other hand, the coefficient on FREQ is 0.305194 yielding a t-value of 1.53 which is significant at the 0.129 level.[6] The regression results are presented in Table VI.

The results reported above are similar although slightly better than, other bond studies (Reiter, 1991), which tested the incremental increase in R^2 resulting from the inclusion of other accounting variables. Additionally, the different significance levels resulting from exclusion/inclusion of accounting variables are also consistent with prior bond studies. As discussed below, the significance of other explanatory variables are also consistent with previous bond premium models.

The results pertaining to nonaccounting and finance variables indicate that these variables impact on bond valuation in the predicted manner. All related coefficients had the expected sign except the interest rate level. The unexpected sign of interest rate level may be

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[6]An estimation of the risk-premium model that included a multiplicative loss contingency variable also yielded significant results (i.e., MULTI = FREQ * LCIDEX). The coefficient on MULTI was 0.052539 yielding a t-statistic of 2.915 which is significant at the 0.0039 level. Moreover, when the multiplicative variable is added to the restricted model the R^2 increases to .6342 which is significant at the .01 level F^* (8.46) > F^c (4.61). The descriptive statistics for MULTI is displayed in Appendix F.

TABLE VI

ESTIMATION RESULTS
Dependent Variable: Y_p, N = 266

RISK-PREMIUM MODEL #2
(Includes FREQ and LCIDEX)

Variable	β_i	Estimate of Coefficient	T for HO: $\beta_i = 0$	PR > |T|	Standard Error of Estimate
Intercept	β_0	1.309417	2.191	0.0294	0.597657
Sub	β_1	2.155454	12.268	0.0001	0.175704
Sink	β_2	-0.268584	-2.144	0.0330	0.125260
Mat	β_3	0.016172	3.147	0.0018	0.005139
Call	β_4	-0.012779	-0.122	0.9030	0.104705
Sig	β_5	3.339696	3.618	0.0004	0.923188
DE	β_6	0.392484	9.639	0.0001	0.040719
Size	β_7	-1.8114E-5	-5.449	0.0001	3.3200E-6
Rate	β_8	-0.151959	-2.626	0.0092	0.057868
FREQ	β_9	0.305194	1.525	0.1285[c]	0.200107
LCIDEX	β_{10}	0.034106	1.735	0.0840[b]	0.019660
R^2		63.55			
Adj.R^2		62.12			
F-Statistic		4.71			

[b]Significant at 0.10 level.

[c]Significant at 0.15 level.

*F-statistic was derived from the linear tests of differential explanatory power of the unrestricted model over the restricted model; where the critical F-statistic, at a significance level of 0.01 is approximately 4.61, with freedom of (2,255).

contributed to the collinearity between the interest rate level and the intercept which is discussed further in the following subsection. Moreover, except for CALL, all variables are significant at less than the .05 level. The insignificance of the CALL variable may indicate little variability in the call variable in the sample of new bond issues. A stepwise regression was run using the restricted model to provide further evidence on the significance of these variables. The results confirm that all variables, except for CALL, are significant at less than the .05 level. A stepwise regression using the unrestricted equation yielded similar results. Results of the stepwise regressions are presented in Tables VII and VIII. The significance levels associated with contingency variables were unaffected by the exclusion of the CALL variable. In this context, recall that the basic theoretical model (3 and 3.a) does not include the CALL variable (CALL was included in the expanded model, equation (8)). Descriptive statistics for the regression model are displayed in Appendix F. The Appendix provides statistics for the dependent and independent variables.

Model Specification Tests Results

One method for determining whether a model is specified properly is the explanatory power. The restricted model has an R^2 and adjusted R^2 of .6221 and .6103, respectively. The R^2's are quite typical for risk premium models. Furthermore, all variables, except for RATE, have the expected sign as summarized previously. Except for one coefficient, CALL, all variables (including the intercept) are strongly significant at less than the .05 level.

TABLE VII

STEPWISE ESTIMATION RESULTS*
Dependent Variable: Y_p, N = 266

STEPWISE ESTIMATION: RISK-PREMIUM MODEL #2
(Excludes FREQ and LCIDEX)

Variable	β_i	Estimate of Coefficient	T for HO: $\beta_i = 0$	PR > F	Partial R^2
Intercept	β_0	1.286384	5.17	0.0239	---------
Sub	β_1	2.124559	147.24	0.0001	0.4095
Sink	β_2	-0.307869	6.43	0.0118	0.0094
Mat	β_3	0.016757	11.38	0.0009	0.0252
Sig	β_5	2.316494	7.15	0.0080	0.0150
DE	β_6	0.399826	97.69	0.0001	0.0882
Size	β_7	-1.8197E-5	34.58	0.0001	0.0630
Rate	β_8	-0.150727	7.06	0.0080	0.0114
R^2		62.17			
Adj.R^2		61.14			

*Variables left in model met the 0.10 significance level for entry into the model.

TABLE VIII

STEPWISE ESTIMATION RESULTS*

Dependent Variable: Y_p, N = 266

STEPWISE ESTIMATION: RISK-PREMIUM MODEL #1
(Includes FREQ and LCIDEX)

Variable	β_i	Estimate of Coefficient	T for HO: $\beta_i = 0$	PR > F	Partial R^2
Intercept	β_0	1.286384	5.17	0.0239	---------
Sub	β_1	2.158976	155.77	0.0001	0.4095
Sink	β_2	-0.272648	5.12	0.0245	0.0071
Mat	β_3	0.016352	11.08	0.0010	0.0252
Sig	β_5	3.346711	13.24	0.0003	0.0150
DE	β_6	0.392944	94.29	0.0001	0.0882
Size	β_7	-1.8190E-5	31.18	0.0001	0.0630
Rate	β_8	-0.150186	7.22	0.0077	0.0112
FREQ	β_9	0.307948	2.41	0.1220	0.0120
LCIDEX	β_{10}	0.034158	3.03	0.0829	0.0043
R^2		63.55			
Adj.R^2		62.27			

*Variables left in model met the 0.15 significance level for entry into the model.

To further ensure that the inferences derived from the estimation results, presented above, are valid. Several model specification tests were conducted. Specifically, tests were conducted to detect omitted variables, heteroscedasticity and collinearity.

Heteroscedasticity

If error terms are homoscedastic, all variances are equal, the estimated parameters are consistent, unbiased and the covariance matrix is correct. The presence of heteroscedasticity implies that the variance of the disturbance term is not the same for all observations. The Goldfeld-Quandt (GQ, 1965)[7] test was use to determine whether the heteroscedasticity presents a problem in this study. The null hypothesis that the error variance in the model is constant for all observations was accepted at a .10% significance level, were the p-value equaled .997 and the non-significant GQ or F-value equaled .61.

Collinearity

Collinearity, a correlation (e.g. or linear dependency) between independent variables can cause a downward bias in parameter estimates and an upward bias in standard error estimates. Tests were conducted to detect the presence of collinearity 1) a test for simple correlation and 2) a test of condition indices (Belsley, Kuh and Welsch, 1980). The first test showed a strong association between the intercept and interest rates (RATE), where the simple correlation is -.8520. Other

[7] $GQ = \sigma_1/\sigma_2 \sim F_{(df1,df2)}$, where σ_1 is the error variance for subset one and σ_2 is the error variance for subset two. The sample was partition into subsets based on the magnitude of assets.

bond studies (e.g., Reiter, 1989) also document a strong relationship between the intercept and the risk-free rate. The correlations between all other pairs of variables were insignificant (i.e., less than .50 percent).

The second test (Belsley et al., 1980) indicates no strong linear dependency between variables, except for the return on firm value (SIG), which has a 'condition index' of 41.3.[8] All other variables are far below the 'condition-index' benchmark tolerance level of 30. Furthermore, the condition index for return on firm value is not associated with a large proportion of variance of two or more coefficients (Belsley et al., 1980); therefore, the regression estimate should not be adversely inflated. Moreover, the mean Variance Inflation Factor (VIF)[9] was not considerably larger than one, indicating no serious collinearity problems (Belsley et al., 1980).

An additional diagnostic for collinearity was also conducted. A regression of the loss contingency variables on the other independent variables indicated that the LCIDEX and FREQ are not extremely associated with the independent variables, which would be the case if the R^2's approached one. The adjusted R^2's are .18 percent and

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[8]The condition-index refers to the condition of the data matrix. Belsley et al. report that the degree of ill-conditioning depends on how small the minimum eigenvalue is relative to the maximum eigenvalue. This implies that the presence of near dependencies results in small eigenvalues. Therefore, an eigenvalue that is small, when compared to the maximum eigen value in the matrix, has a high condition index.

[9]The term variance inflation factor measures the inflation of variances of parameter estimates due to collinearities among regressor variables. The VIF was calculated by summing each coefficient's VIF and dividing by the number of parameters. The mean VIF for the unrestricted and restricted models equaled 1.46 and 1.41, respectively.

.15 percent for FREQ and LCIDEX, respectively. The Pearson Correlation Coefficients indicate a slight correlation among the dependent variables (FREQ and LCIDEX) and the return on firm value (SIG) and debt-to-equity ration (DE). However, both related correlation coefficients are below .40 percent. Since, the Pearson Correlation coefficients are within acceptable ranges, extreme collinearity was not indicated. Thus, the parameter estimates should not be influenced adversely. Table IX lists the Pearson Coefficients applicable to the dependent variables.

Correlation Between Loss Contingency Measures. The mean frequency of disclosures (FREQ) and severity index (LCIDEX) were included jointly and separately in the regression model. The regression results indicate that FREQ and LCIDEX are mildly correlated (-0.4345). Collinearity diagnostics were conducted (Belsley et al., 1980) to determine if the correlation influenced the regression results. Simple correlations were also examined. The highest simple correlation (-.47) was between DE and SIZE. The analysis of the data revealed that 1) the correlation between the contingency variables, and 2) the regression results, were not due to multicollinearity between other explanatory variables.

As mentioned, the simple correlation between the two measures (FREQ and LCIDEX) was -0.4345. Without previous loss contingency studies to use as a benchmark, it is difficult to state further if this level of correlation is typical. However, additional insight can be provided from previous bond risk studies that incorporate more than one accounting variable (Reiter, 1991). For example, the correlation among such variables ranged from .62 to .99. These studies concluded that even a .62 correlation did not present problems with respect to

TABLE IX

MODEL DIAGNOSTICS
CORRELATION BETWEEN CONTINGENCY VARIABLES
AND
OTHER EXPLANATORY VARIABLES

Pearson Correlation Coefficients

β_i	Independent Variable	# of Disclosures (FREQ)	Severity Index (LCIDEX)
1	SUB	-0.1273	-0.0544
2	SINK	-0.0555	-0.0785
3	MAT	0.0973	0.1718*
4	CALL	-0.0970	-0.1409
5	SIG	-0.2983*	-0.3623*
6	DE	0.2561*	0.1912*
7	SIZE	0.1990*	-0.0350
8	RATE	-0.0079	-0.0138
	Adjusted R^2**	.1780	.1486

*Significant at a 0.05 level.

**Adjusted coefficient of determination between each contingency variable and other independent variables.

collinearity. Moreover, the F-test results (equation 19) are unaffected by multicollinearity among variables (Neter and Wasserman, 1974).

Thus, the statistical significance of these contingency variables, the precision of estimated coefficients, and inferences made from comparing the two measures should not have been adversely influenced by this correlation. In short, the separate significance levels of contingency variables described above and related inferences do not appear to be driven by an improperly specified model.

Industry Sector Code

One final regression was run to determine if the regulatory environment of utility firms were associated with risk premiums. For this purpose, a dummy variable was included in the model that was coded 1 for utility companies and zero otherwise. The results indicate that the coefficient was not significantly different from zero at conventional levels. Moreover, no significant increase in explanatory power was evident. Since, the variable was highly correlated with other coefficients (e.g., SIG), it was not included in the original regression models described in Chapter III.

Summary

In summary, the empirical results discussed above indicate that the severity level related to contingency disclosures (LCIDEX) is associated with an increase in bond risk-premiums. The significance of these results permit the rejection of hypothesis H_{01} at conventional levels implying that the severity of contingency disclosures has a significant impact on bond valuation. The proxy for frequency of disclosure (FREQ) also proved to be significant at conventional levels: $\alpha = 0.0123$ when only FREQ was included and $\alpha = 0.1285$ when both FREQ and LCIDEX were included in the bond valuation model. Thus, H_{02} is also rejected at conventional levels implying that the number of loss contingency disclosures increases bond issue premiums. Moreover, the F-tests indicate a significant increase in explanatory power due to the inclusion of LCIDEX and FREQ, reaffirming the notion that loss contingencies are useful in explaining variation in risk premiums.

Finally, all of the conducted model specification tests indicate that the model appears to be correctly specified and that loss contingency variables should not be proxying for missing variables. This implies that both the results and related inferences of the study appear to be valid.

CHAPTER VII

CONCLUSIONS

Overview and Contributions

The purpose of this study was to determine whether a relationship exists between loss contingency disclosures and bond valuation. A theoretical model was developed that established the association between bond valuation and the severity level and frequency of occurrence of loss contingency disclosures. The theoretical model (equation (4)) showed that an increase in risk premiums occurs in the presence of loss contingency disclosures.

Bonds were selected, loss contingency data were examined, and regression equations were estimated in order to empirically test the theoretical model. The sample group consisted of companies that made loss contingency disclosures in the financial statements and also issued bonds within one year of the disclosures. The estimated equations contained proxy variables that represented the elements of the theoretical models (e.g., the bond risk premium, issue traits, default risk and contingency disclosures).

To test the significance of model parameters T and F-statistics were used. The results indicated that, in separate regressions, both the severity index and frequency of disclosure variables were significant. Each variable was also significant when both contingency variables were included in the same regression equation. Furthermore, the results of the F-test indicate that adding the frequency of disclosure to the restricted model significantly increased the R^2. Similarly, when the severity index was added, to the restricted model, the explanatory power also significantly increased. The increase in explanatory power was slightly greater for the severity variable. This finding may suggest that the severity index may have greater incremental information value than the frequency of disclosures. Additional evidence of the incremental information content of the contingency variables is further provided by the F-test results. The greatest increase in R^2 is noted when both the frequency variable and severity variable were included in the restricted model.

The results are consistent with the notion that footnote disclosures and modified reports provide useful information to creditors concerning possible uncertainty surrounding the outcome of a contingency. Furthermore, the results suggests that market participants weigh the severity of a contingency in evaluating the risk premium associated with a new bond issue. Finally, the results indicate that the market is able to impose a higher risk premium on the firms that have a higher mean frequency of loss contingency disclosures.

Overall the results of this study provide a significant contribution to the loss contingency literature in the following respects. First, the study creates a definitive theoretical link between loss contingency disclosures and bond valuation based on continuous-time finance theory. The theory explicitly associated the severity of level and frequency of disclosures with bond valuation. Second, the study extended previous research by investigating a larger sample, including industry sectors not examined previously. Third, the research extends previous research by examining not only the modified report, but also contingency footnotes, and the dollar magnitude of the expected loss. It has been suggested that contingency measures should incorporate the expected dollar magnitude of any potential loss (Dopuch, Holthausen, and Leftwich, 1987). Moreover, the study expanded previous research methodologies by measuring both the severity and frequency of contingency disclosures. Finally, the research results indicate that the footnotes/modified opinion serve a purpose in bond valuation and risk assessment; and therefore, should be an ongoing standard required by policy setters.

Implications for Future Research

The study design did not analyze the level of increase in risk premiums resulting from loss contingency disclosures. However, the research design allowed determination of the additional explanatory power of the loss contingencies over a model without contingencies. Future studies could include a control group to determine this relationship. Matching on financial condition could be accomplished by various methods developed by Ohlson (1980), or Altman's (1968). Both methods consider the firm's financial condition, however, unlike that of Altman, Ohlson's matching procedure takes into account the size of the firm.

Additionally, assumptions were made in order to construct and measure both the severity level of disclosures and the mean number of disclosure occurrences. Future investigation may focus on other methods of measurement such as the number of actual disclosures in each year's financial statements. Moreover, future research could refine the dollar magnitude criteria.

Finally, the insignificance of the callability status requires further investigation. A variable that incorporates a call protection, such as the difference between the yield to the first call date and the bond's offering yield, may better represent the call premium inherent in the risk spread.

Finally, the empirical approach used in this study may be applied to other accounting scenarios that involve an underlying security and a derivative security. Examples, include pension obligations, post-employment benefits other than pensions, earnings announcements, or derivative securities currently being identified by FASB's emerging issues task force.

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APPENDIXES

APPENDIX A

DERIVATION OF BOND VALUATION MODEL

Derivation of Bond Valuation Model

Basic Bond Valuation Equation:

Based on the underlying process of firm value, the foregoing model is derived by applying the Taylor series and Itô's lemma, where Bond value, $B = B(V,\tau)$:

$$dB = B_V dV - B_\tau dt + \tfrac{1}{2}[B_{VV} dV^2 + 2B_{Vt} dVdt + B_{tt} dt^2]$$

where

$\tau = T - t$ and $d\tau = -dt$

T = the maturity date

Using the multiplication rules for Wiener processes where,

$dt^2 = 0$

$dVdt = 0$

the derived equation equals the instantaneous change in bond value:

$$dB = B_V dV + \tfrac{1}{2} B_{VV} dV^2 - B_\tau dt \qquad (A.1)$$

Bond Valuation Equation Without Loss Contingency:

In Chapter III, the following differential equation describes firm value, V, as mostly continuous except for deviations caused by loss contingency disclosures:

$$dV = \alpha V dt + \sigma V dz + \xi dq \qquad (A.2)$$

Now assume that there is no loss contingency (i.e., $dq = 0$); and redefine equation (A.2) as,

$$dV = \alpha V dt + \sigma V dz \qquad (A.3)$$

Substitution of Equation (A.3) into Equation (A.1) yields

$$dB = B_V[(\alpha V)dt + \sigma V dz] + \tfrac{1}{2} B_{VV} \{(\alpha V)dt + \sigma V dz\}^2 - B_\tau dt \qquad (A.4)$$

Since $dt^2 = 0$, $dzdt = 0$, and $dz^2 = dt$ Equation (A.4) can be expressed as follows

$$dB = [B_V(\alpha V) + \tfrac{1}{2}B_{VV}\sigma^2V^2 - B_\tau]dt + B_V\sigma V dz \qquad (A.5)$$

and redefined as

$$dB = \alpha_B B dt + \sigma_B B dz \qquad (A.6)$$

where

$$\alpha_B = \frac{B_V(\alpha V) + \tfrac{1}{2}B_{VV}\sigma^2V^2 - B_\tau}{B}$$

$$\sigma_B = \frac{B_V\sigma V}{B}$$

Following Merton (1973) a three security portfolio is created consisting of the underlying firm value, the firm's corporate bonds and riskless securities. Portfolio weights can be further defined by the following:

W_1 = proportion invested in firm assets

W_2 = proportion invested in corporate bonds

W_3 = proportion invested in riskless debt

As suggested by Merton's (1973) hedge portfolio argument, the total net investment in the portfolio is zero, such that $W_1 + W_2 + W_3 = 0$, where $W_3 \equiv -(W_1 + W_2)$. Letting $r dt$ equal the instantaneous risk-free rate of return, the return on this portfolio can be described as

$$dX = W_1\left(\frac{dV}{V}\right) + W_2\left(\frac{dB}{B}\right) + W_3(r dt) \qquad (A.7)$$

Substituting Equations (A.3 and A.6) into Equation (A.7) yields

$$dX = W_1\frac{(\alpha V dt + \sigma V dz)}{V} + W_2\frac{(\alpha_B B dt + \sigma_B B dz)}{B} - [W_1 + W_2](r dt)$$

$$dX = W_1(\alpha - r)dt + W_2(\alpha_B - r)dt + dz(W_1\sigma + W_2\sigma_B) \qquad (A.8)$$

where $W_3 = -(W_1 + W_2)$ has been substituted out.

As implied previously, the portfolio strategy is to select weights such that the coefficients of dz always yield zero. In this context, dX is non-stochastic. Furthermore, since the portfolio requires zero net investment in order to avoid arbitrage profits, the expected return on the portfolio, dX, must equal zero:

$$W_1(\alpha - r) + W_2(\alpha_B - r) = 0 \qquad \text{no arbitrage opportunities}$$

$$W_1\sigma + W_2\sigma_B = 0 \qquad \text{no risk}$$

The above system of equations has a nontrivial solution if and only if

$$\begin{bmatrix} \sigma & \sigma_B \\ \alpha - r & \alpha_B - r \end{bmatrix} = 0$$

So $\sigma(\alpha_B - r) - \sigma_B(\alpha - r) = 0$ or $\dfrac{\alpha - r}{\sigma} = \dfrac{\alpha_B - r}{\sigma_B}$

By substitution,

$$\frac{\alpha - r}{\sigma} = \frac{B_V(\alpha V) + \frac{1}{2}B_{VV}\sigma^2V^2 - B_\tau}{B} - r \Big/ \frac{B_V\sigma V}{B}$$

$$\frac{\alpha - r}{\sigma} = \frac{B_V(\alpha V) + \frac{1}{2}B_{VV}\sigma^2V^2 - B_\tau - rB}{B_V\sigma V}$$

$$B_V\sigma V(\alpha - r) = \{B_V\alpha V + \tfrac{1}{2}B_{VV}\sigma^2V^2 - B_\tau - rB\}\sigma$$

$$B_V\alpha V - rB_VV = B_V\alpha V + \tfrac{1}{2}B_{VV}\sigma^2V^2 - B_\tau - rB$$

Cancelling of terms yields a partial differential equation of bond value, without a loss contingency:

$$\mathfrak{r}B = B_V \mathfrak{r}V + \tfrac{1}{2}B_{VV}\sigma^2V^2 - B_\tau$$

$$0 = \tfrac{1}{2}B_{VV}\sigma^2V^2 + \mathfrak{r}VB_V - \mathfrak{r}B - B_\tau \tag{A.9}$$

Bond Valuation Equation with Loss Contingency:

As mentioned above the occurrence of a loss contingency disclosure, can be represented by the dynamics of equation (A.2):

$$dV = \alpha Vdt + \sigma Vdz + \xi dq$$

where $\xi dq \equiv - \rho\lambda Bdt$. As developed in Chapter III, $- \rho\lambda Bdt$ equals the expected change in bond value given a loss contingency. By substituting equation (A.2) into equation (A.1) we obtain:

$$dB = B_V[(\alpha V)dt + \sigma Vdz - \rho\lambda Bdt] +$$
$$\tfrac{1}{2}B_{VV}\ \{[(\alpha V)dt + \sigma Vdz - \rho\lambda Bdt]^2\} - B_\tau dt \tag{A.10}$$

Since $dt^2 = 0$, $dzdt = 0$, and $dz^2 = dt$ Equation (A.10) may be rewritten as,

$$dB = [B_V(\alpha V) + \tfrac{1}{2}B_{VV}\sigma^2V^2 - B_\tau - \rho\lambda B]dt + B_V\sigma Vdz \tag{A.11}$$

Using Equations (A.2 and A.11), in an attempt to employ the hedge portfolio argument, results in the following portfolio with a return, dX^*

$$dX^* = W_1{,}(\alpha - \mathfrak{r})dt + W_2{,}(\alpha'_B - \mathfrak{r})dt + dz(W_1{,}\sigma + W_2{,}\sigma'_B)$$
$$+ dq\{W_1{,}(\xi) + W_2{,}[B(V - \xi) - B(V)]\} \tag{A.12}$$

where,

$$\alpha'_B = \frac{B_V(\alpha V) + \tfrac{1}{2}B_{VV}\sigma^2V^2 - B_\tau - \rho\lambda B}{B}$$

$$\alpha'_B = \frac{B_V\sigma V}{B}$$

and, ξ and $B(V - \xi) - B(V)$ equal the percentage change in value caused by the loss contingency for the firm and bond, respectively.

However, equation (A.12) consists of an additional source of risk which makes the hedge portfolio technique invalid. Merton (1976) has demonstrated that in the presence of a jump process dq, the return on the portfolio with weights W_1, and W_2, is not riskless. Analysis indicate that portfolio weights do no exist that would eliminate both the jump process/stochastic risk (i.e., make the coefficients of dz = 0 and dq = 0).[10] On the other hand the return elements of the portfolio can be obtained by using an approach similar to Ross (1976) and Merton (1976).

This approach supposes that the jump components of bonds are independent. That loss contingencies are unique to a firm and uncorrelated with other firms. Following Ross (1976) and Merton (1976), assume that a population of N, number of firms exists and that a portfolio, dH_j, is created for each of the N firms similar to Equation (A.12). A portfolio consisting of all of these N hedge portfolios and the riskless security is formed where y_j is the proportion invested in the jth hedge portfolio (j = 1,2,3,...,N). The amount invested in the riskless security is equal to $1 - \sum_{j=1}^{N} y_j$. The return of this portfolio (i.e., hedge portfolios) can be described as

$$dW^* = \alpha_W W dt + \xi_W dq_W W \tag{A.13}$$

where,

$$\alpha_W = \sum_{j=1}^{N} y_j \, (\alpha'_j - r) + r \tag{A.14}$$

$$\xi_W = \sum_{j=1}^{N} y_j \xi_j \equiv \sum_{j=1}^{N} y_j [B(V - \xi) - B(V)]_j \tag{A.15}$$

$$dq_W = \sum_{j=1}^{N} y_j dq_j \tag{A.16}$$

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[10]Merton (1976) reasons, in his analysis, that the portfolio weights cannot be eliminated because portfolio combining is a linear operation and the option price is a nonlinear function of the underlying security.

Note that in the Equation (A.13), the continuous components of firm value and bond value (dz) have been eliminated by hedging.

The portfolio weights in each hedge portfolio are restricted and can be defined as $y_j = \mu_j/N$, where μ_j are constants and uncorrelated with N. Also, the portfolio is well-diversified as N becomes larger (Ross, 1976). These two observations and other assumptions (see Merton, 1976) allow the following conclusions. As the number of hedge portfolios included in the well-diversified portfolio increases ($N \to \infty$), the variance (dq_W) approaches zero and the portfolio risk becomes nearly risk-free. Therefore, the return on dW^* will equal its expected return $\alpha_W dt$; and, in order to ensure no arbitrage opportunities, α_W will equal the riskless rate. Moreover, it can be shown (using $y_j = \mu_j/N$) that for large N, α'_j also equals r. Recall that $\alpha'_j = r$ implies that $\frac{\alpha - r}{\sigma}$ equals $\frac{\alpha_B - r}{\sigma_B}$, which was the solution required to obtain Equation (A.9). Therefore, the above approach (which uses the Law of Large Numbers) illustrates that the jump-risk component is diversifiable and the bond valuation model, given a loss contingency can be written as

$$rB = \tfrac{1}{2} B_{VV}\sigma^2 V^2 + rVB_V - B_\tau - \rho\lambda B$$

$$0 = \tfrac{1}{2} B_{VV}\sigma^2 V^2 + rVB_V - rB - B_\tau - \rho\lambda B \qquad \text{(A.17)}$$

The bond value equation can alternatively be expressed in the form below.

$$\tfrac{1}{2} B_{VV}\sigma^2 V^2 + rVB_V - (r + \rho\lambda)B = B_\tau \qquad \text{(A.18)}$$

APPENDIX B

DERIVATION OF EQUATION 4

Derivation of Equation 4

Assumptions about the effects of information on security price changes results in valuation models based on a variety of stochastic processes. Given the type of boundary conditions which must meet the value of the contingent claim and complex payout or settlement contingencies, partial differential equations, such as equation (3, 3.a), may or may not have an analytic solution. Examples of analytic solutions derived, include the value of a call option of Black and Scholes (1973) and Merton (1973), the risky corporate discount bond model of Merton (1974), the convertible bond model of Ingersoll (1977), and the stock-return jump-diffusion model of Merton (1976). However, because of payout or exercise or other contingencies, in the model, analytic solutions are rare. An analytic solution to the parabolic partial differential equation (3, 3.a), is unobtainable, at this time. Thus, an approximate approach to the solution is used called the explicit finite difference technique.

The finite difference method analyzes the partial differential equation (3.a) by using discrete estimates of the changes in the bond value for small changes in time and firm value to derive difference equations that approximate the continuous partial derivatives. Forward difference is used for the first derivative of τ. While central differences are employed for the first and second derivatives of bond value, W(Y). In this explicit method, each unknown bond price at any point in time can be solved explicitly by using previous known bond prices.

The fundamental equation (referred to before as (A.18) and (3.a)) is

The fundamental equation (referred to before as (A.18) and (3.a)) is

$$\tfrac{1}{2}B_{vv}\sigma^2V^2 + rVB_v - (r + \rho\lambda)B = B_\tau$$

where the terms are defined in Chapter III. The partial differential equation has variable coefficients that further make the numerical solving more difficult. However, by deriving the log transform of the equation the numerical procedure is simplified since the coefficients become constants. This transformation is accomplished below.

1. Let

$W(Y,\tau) = B(V,\tau)$

$Y = \ln_e V$ (i.e., $Y = \ln_e V \equiv V = e^y$)

and

$dB/dV = dw/dy * dy/dv$

then,

$B_v = W_y\,(dy/dv)$

since $y = \ln V$, then $dy/dv = 1/V = 1/e^y$ and

$$B_v = W_y e^{-y} \tag{B.1}$$

Similarly,

$$B_{vv} = (W_{yy}(dy/dv)\ e^{-y}) + W_y-(e^{-y})(e^{-y})$$

which simplifies to

$$B_{vv} = (W_{yy} - W_y)e^{-2y} \tag{B.2}$$

Finally,

$$B_\tau = W_\tau \tag{B.3}$$

Making the appropriate substitutions of (B.1 - B.3) into equation (3.a) and simplifying, derives the transformed equation

$$W_\tau = \tfrac{1}{2}W_{yy}\sigma^2 - \tfrac{1}{2}\sigma^2W_y + rW_y - rW - \rho\lambda W \tag{B.4}$$

2. The finite difference approximation to equation (B.4) is derived by substituting the partial derivatives with finite differences. Let $W(Y,\tau) = W(ih,jk) = W_{i,j}$, where h and k are the increment changes in firm value and time to maturity, respectively. The partial derivatives and constant terms are defined as:

$$W_\tau = (W_{i,j+1} - W_{i,j})/k \quad (B.5)$$

$$W_{yy} = (W_{i+1,j} - 2W_{i,j} + W_{i-1,j})/h^2 \quad (B.6)$$

$$W_y = (W_{i+1,j} - W_{i-1,j})/2h \quad (B.7)$$

$$rw = rW_{i,j+1} \quad (B.8)$$

$$\rho\lambda W = \rho\lambda W_{i,j+1} \quad (B.9)$$

Substitution of (B.5 - B.9) into (B.4) and simplifying yields

$$\begin{aligned} W_{i,j+1} = {} & [(\tfrac{1}{2}\sigma^2 W_{i+1,j} - \sigma^2 W_{i,j}, + \tfrac{1}{2}\sigma^2 W_{i-1,j})/h^2]k \\ & + [(rW_{i+1,j} - rW_{i-1,j}) - (\tfrac{1}{2}\sigma^2 W_{i+1,j} - \tfrac{1}{2}\sigma^2 W_{i-1,j})]/2hk \\ & - (rW_{i,j+1} + \rho\lambda W_{i,j+1})k + W_{i,j} \end{aligned}$$

Grouping and then simplifying of terms results in

$$\begin{aligned} W_{i,j+1} = {} & [\tfrac{1}{2}(\sigma/h)^2 - \tfrac{1}{2}(r - \tfrac{1}{2}\sigma^2)/h]k\ W_{i-1,j} \\ & + [1 - (\sigma/h)^2 W_{i,j} - (r + \rho\lambda)W_{i,j+1}]\ k \\ & + [\tfrac{1}{2}(\sigma/h)^2 + \tfrac{1}{2}(r - \tfrac{1}{2}\sigma^2)/h]k\ W_{i+1,j}. \end{aligned}$$

Subtracting $[(r + \rho\lambda)k]W_{i,j+1}$; and dividing by $(r + \rho\lambda)k$; results in equation (B.10) below, where the coefficients sum to one. Because these coefficients add to one each is regarded as a probability which allows for the calculation of the expected bond value at $\tau = j$ (i.e., the future bond value). The expected value is discounted at the riskless rate, r, if there is no loss contingency. However, if a loss contingency is present the riskless rate is augmented by $\rho\lambda$. The discounted expected value represented by $W_{i,j+1}$, is the present value of the bond at $\tau = j+1$.

$$W_{i,j+1} = 1/(1 + (r + \rho\lambda)k)\ [aW_{i-1,j} + bW_{i,j} + cW_{i+1,j}] \tag{B.10}$$

where,

$a = [\frac{1}{2}(\sigma/h)^2 - \frac{1}{2}(r - \frac{1}{2}\sigma^2)/h]k$

$b = [1 - (\sigma/h)^2 k]$

$c = [\frac{1}{2}(\sigma/h)^2 + \frac{1}{2}(r - \frac{1}{2}\sigma^2)/h]k$

$i = (1,2,3...n)$

$j = (1,2,3,...m)$

Initial and Boundary Conditions

The initial conditions follow from the assumptions: (a) that the firm promises to pay to bondholders a total of W^*, at maturity date; and (b) the bondholders take over the firm if payment is not made. Under assumption (b), the shareholders receive nothing from the firm. Therefore, value of debt, or analogously, the distribution to bondholders, given $\tau = 0$ and $0 \leq Y < \infty$ is

$$W(Y,0) = \min\ (Y - \rho Y, W^*) \tag{B.11}$$

This initial condition implies that bondholders would receive W^*, if the firm value is greater than the total amount of promised payment. However, if the firm value is less than the total promised payment, W^*, bondholders receive $Y - \rho Y$, the firm value less the contingency settlement.

The boundary conditions are also derived from the above assumptions. Because of the limited liability of claims, W can only be nonnegative and never more than the maturity value; therefore, the boundary conditions are

$$W(0,\tau) = 0 \qquad \text{(B.11a)}$$

$$W(Y,\tau)/Y \leq 1 \qquad \text{(B.11b)}$$

Boundary condition (B.11b), which implies that $W(Y,\tau) \leq Y$, represents the boundary problem where $0 \leq Y < \infty$. These initial and boundary conditions could be used in the finite difference simulation to obtain approximate bond model prices.

APPENDIX C

COMPANY NAMES, LOSS CONTINGENCY YEAR AND NUMBER OF BOND ISSUES

COMPANY, YEAR OF CONTINGENCY DISCLOSURE, NUMBER OF ISSUES

#.	Company Name	Contingency Year	Bonds
1.	ALLIED SIGNAL, INC.	90	1
2.	AMERICAN BRANDS INC-DEL	85,86,88,89,90	6
3.	AMERICAN TELEPHONE & TELEGRAPH	85	1
4.	ANADARKO PETROLEUM, CORP.	90	1
5.	ARKLA, INC.	85,87,88	3
6.	ARMCO, INC.	86	1
7.	ATLANTIC RICHFIELD, CO.	90	1
8.	BALTIMORE GAS & ELECTRIC	85,89	2
9.	BELO (A.H.) CORP.	86	1
10.	BOEING. CO.	90	1
11.	BOISE CASCADE CORP.	85,87,89	3
12.	BOSTON EDISON CO.	89	1
13.	CAROLINA POWER & LIGHT	85,89	2
14.	CARTER HAWLEY HALE STORES	84	2
15.	CATERPILLAR, INC.	86	1
16.	CENTRAL HUDSON GAS & ELECTRIC	90	2
17.	CHAMPION INTERNATIONAL CORP.	85,89,90	3
18.	CHESAPEAKE CORP.	84,85,89	3
19.	CHEVRON CORP.	90	1
20.	CHIQUITA BRANDS, INTERNATIONAL	90	1
21.	CHRYSLER CORP.	84,86	2
22.	CINCINNATI GAS & ELECTRIC	84,85,89	3
23.	COASTAL CORP.	85,88,90	3
24.	COCA-COLA CO.	90	1
25.	COMMONWEALTH EDISON	84,86,87,88,89,90	6
26.	CONSOLIDATED EDISON OF NY	89	1
27.	CORNING INC.	85,86,90	3
28.	CSX CORP.	85	1
29.	DAYTON HUDSON CORP.	85	1
30.	DELMARVA POWER & LIGHT	85,87	2
31.	DETROIT EDISON CO.	85,86,88	3
32.	DOMINION RESOURCES INC.	85,86,87,88,89	5
33.	DOW JONES & CO. INC.	86,88	2
34.	DQE INC.	85,86	2
35.	DU PONT (E.I.) DE NEMOURS	85,88,90	3
36.	DUKE POWER CO.	84,85,86,90	4
37.	EASTMAN KODAK CO.	85,86,87,90	4
38.	EATON CORP.	88	1
39.	ENGELHARD CORP.	87	1
40.	ENRON CORP.	86,87,88,90	4
41.	ENSERCH CORP.	84	1
42.	FAIRFIELD COMMUNITIES, INC.	84	1
43.	FEDERAL-MOGUL CORP.	85	1
44.	FLEMING COMPANIES INC.	85	1
45.	FMC CORP.	85	1
46.	FORD MOTOR COMPANY	84,85,90	3
47.	FPL GROUP INC.	86	1

COMPANY, YEAR OF CONTINGENCY DISCLOSURE, NUMBER OF ISSUES

#.	Company Name	Contingency Year	Bonds
48.	GANNETT CO.	85	1
49.	GENERAL ELECTRIC CO.	86	1
50.	GEORGIA-PACIFIC CORP.	86	1
51.	GRACE (W.R.) & CO.	84	1
52.	GRUMMAN CORP.	85	1
53.	GULF STATE UTILITIES CO.	85,90	2
54.	HERCULES INC.	84	1
55.	HONEYWELL INC.	85	1
56.	ICN PHARMACEUTICALS INC-DEL	85	1
57.	IDAHO POWER CO.	88	1
58.	ILLINOIS POWER CO.	85,87	2
59.	IMO INDUSTRIES INC.	88	1
60.	INGERSOLL-RAND CO.	90	1
61.	INTERNATIONAL BUSINESS MACHINES CORP.	84	1
62.	INTERNATIONAL PAPER	84,89	2
63.	JOHNSON & JOHNSON	86,89	2
64.	K N ENERGY INC.	87,90	2
65.	KANSAS CITY POWER & LIGHT	85	1
66.	KANSAS GAS & ELECTRIC	85,86	3
67.	KERR-MCGEE CORP.	85	1
68.	KEYSTONE INTERNATIONAL	85	1
69.	KNIGHT-RIDDER INC.	85	1
70.	KROGER CO.	88	1
71.	LAMSON & SESSIONS CO.	86	1
72.	LONG ISLAND LIGHTING	84,85,88,90	4
73.	LVI GROUP INC.	87	1
74.	MARTIN MARIETTA CORP.	86,87,90	3
75.	MATTEL INC.	84,86	2
76.	MAYTAG CORP.	86,88,89	3
77.	MCDONALDS CORP.	84	1
78.	MCDONNELL DOUGLAS CORP.	84	1
79.	MOBIL CORP.	84,85,86,90	4
80.	MONSANTO CO.	85,88,90	3
81.	NATIONAL FUEL GAS CO.	85	1
82.	NEW YORK STATE ELECTRIC & GAS	85,89	2
83.	NEWELL COMPANIES	86	1
84.	NICOR INC	84	1
85.	NIAGARA MOHAWK POWER	85,87,88,89	4
86.	NIPSOCO INDUSTRIES INC.	85	1
87.	NORTEK INC.	84,85	2
88.	NORTHEAST UTILITIES	90	1
89.	NORTHERN STATES POWER-MN	89	1
90.	NYNEX CORP.	89	1
91.	OHIO EDISON CO.	88	1
92.	ONEOK INC.	89	1
93.	OWENS CORNING FIBERGLASS	85	1
94.	PACIFIC ENTERPRISES	89	1

COMPANY, YEAR OF CONTINGENCY DISCLOSURE, NUMBER OF ISSUES

#.	Company Name	Contingency Year	Bonds
95.	PACIFIC GAS & ELECTRIC	84,85,89,90	4
96.	PACIFICORP	85	1
97.	PANHANDLE EASTERN CORP.	85,86,88	3
98.	PENNSYLVANIA POWER & LIGHT	85,88,90	3
99.	PENNZOIL CO.	85,86,88,89	4
100.	PEPSICO INC.	86,87	2
101.	PFIZER INC.	90	1
102.	PHILADELPHIA ELECTRIC CO.	85,87,88,89	4
103.	PHILIP MORRIS COMPS. INC.	84,85,87,88,89,90	6
104.	PHILLIPS PETROLEUM CO.	90	1
105.	PORTLAND GENERAL CORP.	85	1
106.	POTLATCH CORP.	85,88	2
107.	PREMARK INTERNATIONAL INC.	89	1
108.	PROCTER & GAMBLE CO.	90	1
109.	PUBLIC SERVICE CO. OF COLORADO	86,89	2
110.	PUBLICKER INDUSTRIES INC.	85	1
111.	PUGET SOUND POWER & LIGHT	85,86,89	3
112.	QUESTAR CORP.	89,90	2
113.	ROCHESTER GAS & ELECTRIC	85,86,90	3
114.	ROCHESTER TELEPHONE CO.	88,90	2
115.	ROHM & HAAS CO.	87,88,89	3
116.	RYLAND GROUP INC.	86	1
117.	SAN DIEGO GAS & ELECTRIC	89	1
118.	SANTA FE PACIFIC CORP.	87	1
119.	SCOTT PAPER	84,85,89	3
120.	SEALED AIR CORP.	88	1
121.	SEARS ROEBUCK & CO.	88,89,90	3
122.	SONAT INC.	85	1
123.	SOUTHERN CO.	85,86,87,90	4
124.	STONE CONTAINER CORP.	84,88,90	3
125.	SUN CO. INC.	90	1
126.	SUNDSTRAND CORP.	85	1
127.	TENNECO INC.	90	1
128.	TEXAS INSTRUMENTS INC.	90	1
129.	TOSCO CORP.	85	1
130.	TRANSCO ENERGY CO.	89,90	2
131.	UNION CARBIDE CORP.	86	1
132.	UNION ELECTRIC CO.	85,90	2
133.	UNION PACIFIC CORP.	85,86,87	3
135.	UNOCAL CORP.	90	1
136.	UPJOHN CO.	85	1
137.	USG CORP.	86	1
138.	WASHINGTON WATER POWER CO.	83,85	2
139.	WESTINGHOUSE ELECTRIC CORP.	85,90	2
140.	WHIRLPOOL CORP.	85,90	2
141.	WILLIAMS COMPANIES INC.	87,89	2

COMPANY, YEAR OF CONTINGENCY DISCLOSURE, NUMBER OF ISSUES

#.	Company Name	Contingency Year	Bonds
142.	WISCONSIN PUBLIC SERVICE	90	1
143.	XEROX CORP.	85,87,88,89	4
144.	ZENITH ELECTRONICS CORP.	84	1

APPENDIX D

COMPANY AND BOND DESCRIPTIVE STATISTICS

Company Financial Statistics

Attribute (Million $)	Mean	Standard Deviation	Minimum	Maximum
Assets	10,024.91	16,085.92	33,683.00	173,662.00
Current Liabilities	3,096.83	9,598.23	9,025.00	105,092.11
Long-Term Debt	2,573.44	3,815.29	1,428.00	4,5331.80
Common Equity	3,080.84	3,915.56	-2,928.50	26,489.01
Equity	3,333.22	3,991.37	-2,678.42	26,489.00
Operating Income	1,316.16	1,955.67	-1,352.00	15,419.75

Financial Data Sources

Data Item	Definition and Source
Assets	(SIZE), COMPUSTAT item #6
Current Liabilities	COMPUSTAT item #5
Long-term Liabilities	COMPUSTAT item #9
Common Stock Equity	Year-end, COMPUSTAT item #199
Number of Shares Outstanding	Year-end, COMPUSTAT item #25
Operating Income	COMPUSTAT item #13
Stockholders Equity	COMPUSTAT item #216
Number of Shares Outstanding	Monthly, CRISP item 'curshr'
Common Stock Price	Monthly, CRISP item 'prc'
Common Stock Return	Monthly, CRISP item 'ret'

Bond Statistics

Attribute n = 266	Mean	Standard Deviation	Minimum	Maximum
Face rate (%)	9.689	1.389	7.00	16.00
Price (%)	99.547	.996	85.910	100.000
Offering yield (%)	9.762	1.377	7.000	16.000
Treasury yield (%)	8.419	0.929	6.64	12.400
Yield Premium (%)	1.343	1.130	.0300	7.300
Maturity (years)	16.417	10.082	2.000	40.000
Issue Size (million $)	162.164	112.717	7.20	783.000

Moody's Bond Rating

Moody's Bond Rating	Frequency	Percent
Aaa	7	2.6
Aa1-Baa3	228	85.6
Ba1-Ba3	8	3.1
B1-B3	18	6.8
Caa-C	4	1.5
Non-rated	1	.4
Total	266	100.0

Yearly Distribution of Bond Issues

Issue Year	Frequency	Percentage
1984	1	00.4
1985	25	09.4
1986	68	25.6
1987	37	13.9
1988	23	08.6
1989	30	11.3
1990	35	13.2
1991	47	17.6

APPENDIX E

LOSS CONTINGENCY DISCLOSURE STATISTICS

Severity Index and Frequency Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
LCIDEX	3.617	2.656	1.000	11.000
FREQ*	0.668	0.266	0.125	1.000

*FREQ = (Total Occurrences/8).

Severity Index

Firm's Total Weighted Index	Frequency	Percent
1	55	20.7
2	70	26.3
3	36	13.5
4	35	13.2
5	16	6.0
6	14	5.3
7	9	3.4
8	7	2.6
9	10	3.8
10	8	3.0
11	6	2.3
Total	266	100.0

Frequency of Occurrences

Firm's Total Occurrence*	Total Count of Each Occurrence # from 1983 to 1990	Percent
1	17	6.4
2	13	4.9
3	28	10.5
4	26	9.8
5	53	19.2
6	35	13.2
7	36	13.5
8	58	21.8
TOTAL	266	100.0

*One occurrence was recorded if the financial statement either contained 1) several disclosures, 2) a modified report, or 3) contained the materiality criteria mentioned under severity index in Chapter IV.

APPENDIX F

REGRESSION MODEL STATISTICS

Regression Model Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum	Coded 1	Sample %
Y_p	1.343	1.130	0.03	7.30		
SINK					214	80.5
CALL					112	42.1
SUB					22	8.3
DE	1.389	1.417	0.017	11.941		
SIZE	10024.91	16085.92	33.683	173662.00		
MAT	16.417	10.082	2.000	40.000		
RATE	8.419	0.780	7.905	12.400		
SIG	0.120	0.061	0.008	0.350		
FREQ	0.668	0.226	0.125	1.000		
LCIDEX	3.617	2.656	1.000	11.000		
MULTI	2.775	2.612	0.125	11.000		

VITA

Ida B. Robinson

Candidate for the Degree of

Doctor of Philosophy

Thesis: AN EXAMINATION OF BOND VALUATION IN THE PRESENCE OF LOSS CONTINGENCY DISCLOSURES: A CONTINUOUS-TIME FINANCE THEORY APPROACH

Major Field: Business Administration--Accountancy

Biographical:

Personal Data: Born in Bristol, Virginia, November 23, 1948, the daughter of Patrick Henry and Bettie Naomi Lacy Robinson, Jr.

Education: Attended Slater High School, grades 1 thru 11, in Bristol, Tennessee; graduated from Bristol Tennessee High School, in June, 1966; received Bachelor of Arts Degree in Psychology from Fisk University at Nashville, Tennessee, in May, 1970; received Master of Arts Degree in General Psychology from Columbia University at New York, New York, in February, 1972; received the Master of Business Administration Degree in Accounting from St. John's University at Jamaica, New York, in August, 1980; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in December, 1993.

Professional Experience: Auditor for various firms which included KPMG Peat Marwick, New York, New York; Price Waterhouse, New York, New York; and Harris, Harris & Co., Greensboro, North Carolina; Certified Public Accountant, North Carolina, in December, 1985; Instructor of Accounting, North Carolina A&T State University, January, 1982 to May, 1989; Teaching Assistant, Oklahoma State University, August, 1989 to January, 1990 and August 1992 to May 1993; Assistant Professor, North Carolina A&T State University, December, 1993, to present.