CHAPTER 3

Conceptual Framework and Research Methodology

3.1 Literatures Review

This section will detail the related studies of the association between systematic risk measures for bond and default risk.

(1) Systematic Risk and Corporate Variables

The study of individual firms' risk as related to their underlying characteristics begins with the work of Beaver, Kettler, and Scholes (1970)[1]. They examined the relationship of certain accounting ratios (payout, liquidity, earning variability, etc.) to firms' systematic risk, and found a strong and significant association between them.

Breen and Lerner (1973)[2] examined the relationship between different corporate vareables and systematic risk in the period 1965-1970 by using monthly return of 1400 companies. They used 7 explanatory variables to explain the variations in β values which are the ratio of debt to equity, the ratio squared of debt to equity, the growth of earnings, the stability of the growth in earnings, size of company, dividend payout ratio, and number of shares traded. They found that the signs of the coefficients of the financial variables that were studied usually behave the way that the traditional corporate finance literature suggests

---

[1] William Beaver, Pual Kettler, and Myron Scholes, " The Association Between Market Determined and Accounting Determined Risk Measures ", *The Accounting Review*. Vol.45, No.4, 1970

[2] William J.Breen and Eugene M.Lerner, " Corporate Financial Strategies and Market Measures of Risk and Return ", *Journal of Finance*. Vol.28, No.2, 1973

that they should. Thus, the stability of earnings growth, company size and the payout ratio have predominately negative coefficients while the growth rate and the number of shares traded have predominately positive coefficients. The effect of the debt equity ratio was much less stable than the other explanatory variable. Morover, they found that the firm's internal financial policy decision affect the market expectations of investors and, therefore, the volatility of the firm's equity securities.

Ben-Zion and Shalit (1975)[3] investigated the empirical determinants of equity risk through the analysis of the firm's underlying characteristics, specifically, the firm's size, its financial leverage, and its dividend record. They separated equity risk into the three alternative risk measures which are earnings dividend ranking, beta risk measure, and stock turnover ratio. The empirical results indicated that all three alternative risk measures, is positively related to its leverage and negatively related to its size and dividend record.

Melicher and Rush (1977)[4] attempted to explain changes in the beta of electric utility firms produced less than totally satisfying results. 28 financial variables were identified for purposes of examination. Consequently, the large original data set were condensed into fewer basically independent financial demensions : 1) financial leverage; 2) firm size; 3) earning trend and stability; 4) operating efficiency; 5) financing policy or strategy; 6) rate of return on investment; and 7) common stock market activity. As the results, only approximately 25% of the relative changes in betas was explained by financial

---

[3] Uri Ben-Zion and Sol S. Shalit. " Size, Leverage, and Dividend Record As Determinants of Equity Risk", *Journal of Finance*. Vol.30, No.4, 1975

[4] Ronald W. Melicher and David F. Rush. " Systematic Risk, Financial Data, and Bond Rating Relationships In A Regulated Industry Environment ", *Jounal of Finance*, Vol.32, No.3, 1977

characteristics. Relatively higher betas were maintained by utilities which exhibited more favorable changes in their EPS growth trends, utilized riskier financial leverage and asset financing policies.

(2) Default Risk and Corporate Variables

Bond ratings traditionally have been viewed as composite indicators of default risk. Consequently, the rating assigned to a bond is widely accepted as having a significant influence on the returns required by investors. Several studies attempted to use corporate variables to predict a firm's bond ratings.

Fisher Lawrence (1959)[5] has focused on individual firm's risk-rate of return relationship through an empirical analysis of the mean and the higher moments of the rate of return distribution. The study was not directed at bond ratings, but toward explaining risk premiums on corporate bonds. The results indicated that firm's size and leverage are important risk determinants of corporate bonds.

Altman I. Edward (1968)[6] suggested that traditional ratio analysis is no longer an important analytical technique in the academic environment due to the relatively unsophisticated manner in which it has been presented. In order to assess its potential rigorously, a set of financial ratio was combined in a discriminant analysis approach to the problem of corporate bankruptcy prediction. The theory is that ratios, if analyzed within a multivariate framwork (MDA), will take on greater statistical significance than the common technique of sequential

---

[5] Lawrence Fisher " Determinants of Risk Premiums on Corporate Bonds ", *Journal of Political Economy*, Vol.67, 1959

[6] Edward I. Altman " Financial Ratios, Discriminant Analysis and The Prediction of Corporate Bankruptcy ", *Journal of Finance*, Vol.23, No.4, 1968

ratio comparisons. The MDA model proved to be extremely accurate in predicting bankruptcy correctly in 94% of initial sample with 95% of all firms in the bankruptcy and non-bankruptcy groups assigned to their actual group classification.

Pinches and Mingo (1973)[7] developed and tested a model for predicting industrial bond ratings by the use of multiple discriminant analysis (MDA). Financial data were collected and calculated on 35 different variables. The final MDA model incorporating 6 variables correctly predicted 69.70% of the actual ratings in the original sample, and predicted approximately 60% of the ratings for a holdout sample and another sample of newly rated bonds. The best replications of Moody's ratings were obtained when variables relating to earnings stability, size, financial leverage, debt and debt coverage stability, return on investment, along with subordination, were considered. The model performed very poorly for Baa rated bonds due to a lack of statistically significant differences in the quantifiable variables considered for inclusion in the model.

(3) Systematic Risk and Default Risk

The market model indicates that the return on a security is a function of its systematic risk. However, the usual perception of bond risk is to consider separately interest rate risk and default risk. Default and interest rate risk are systematic risk in nature according to the following studies :

Frank R. Reilly and Michael D. Joehnk (1976)[8] paid attention to the estimation and use of a market determinded risk measure for bond and a

---

[7] George B.Pinches and Kent A.Mingo " A Multivariate Analysis of Industrial Bond Ratings ",*Journal of Finance*, Vol.28, No.1, 1973

[8] Reilly , R.,and M.Joehnk , " The Association Between Market Determined Risk for Bonds and Bond Ratings " , *Journal of Finance* , December 1976

comparative analysis of this risk measure and the bond's assigned agency rating. Using Baa and higher rated bonds in the industrial (26 issues) and public utility (47 issues) sectors of the corporate bond market during 1967-1972 with all issues maintaining the given rating for the complete period of analysis. They did not include lower rated bond because they concentrated on the investment grade bonds for investment banking. The empirical result found no relationship between beta and ratings.

M. Weinstien (1981)[9] studied the systematic of corporate bonds which related to the default risk and the interest rate risk. For default risk, the empirical result indicated a direct relationship between the systematic risk and bond ratings over the 1969-1972 period (1967-1974 data). The difference between these two studies may rest on that Reilly and Joehnk who limited themselves to 73 bonds with very little spread in maturity date or coupon level. They also considered only bonds that were in the top four rating grades. But Weinstien did not impose any maturity, coupon, or rating constraint and used the number of bonds in the sample at any point in time varies from 123 to 315.

Interest rate risk is a function of the duration of the bond when the bond is default-free. Alexander and R.A.Jarrow (1978)[10] indicated that bonds with longer durations will have larger betas. However, there are several problems with this relationship. The most important problem is that a bond's interest rate risk, as measured by duration, continually changes as the bond matures, thereby making the bond's beta unstable overtime.

---

[9] Weinstein M. , " The Systematic Risk of Corporate Bonds " , *Journal of Financial and Quantitative Analysis* , September 1981

[10] Alexander and Jarrow,R., " The Relationship Between Yield , Risk and Return of Corporate Bonds ", *Journal of Finance* , September 1978.

(4) Bond and Bond Rating Changes

Bond rating agencies will change a firm's bond rating based on a specific event, such as the announcement of new debt financing, new equity financing, a merger ; or a gradual change in the firm's financial condition which the agency observes during their periodic review process. Absolutely, the change in bond rating will effect the bond market.

Steven Katz (1974)[11] developed an event-oriented procedure for testing the efficiency of the bond market, analyzed the price adjustment process of bonds to rating reclassification. The empirical result found no market inefficiencies concerning bond rating changes for public utility bonds. As a result, investors could not earn abnormal profits on the basis of public reports of rating changes.

P.Grier and S.Katz (1976)[12] examined public utility and industrial bond prices and found the market to be efficient with respect to rating changes for public utility bonds. However, they did find that the market was inefficient with respect to bond rating decreases for industrial bonds.

M. Weinstien (1977)[13] analyzed the monthly market price changes of 132 different bond rating changes. The empirical result reported that bond prices experienced a statistically insignificant price reaction during the month in which their rating was changed and bond prices accomplished most of their price

---

[11] Katz Steven , " The Price Adjustment Process of Bonds to Rating Reclassification : A Test of Bond Market Efficiency " , *Journal of Finance* , May 1974.

[12] Grier,P. and Katz,S., " The Differential Effects on Bond Rating Changes Among Industrial and Public Utility Bonds by Maturity" ,*Journal of Business*, April 1976.

[13] Weinstien M., " The Effect of Rating Change Announcement on Bond Prices " ,*Journal of Financial Economics* , December 1977.

reaction to a rating change during the year preceding the announcement of the rating change.

(5) Analysis of Price-Earning Ratio

Several studies have been conducted in an attempt to bring some evidence to the problem of P/E ratio. The analysts selected factors or variables, they believes, would be the main influences on the price of stock in correlation analysis.

Whitbeck and Kisor (1963)[14] studied a number of stocks over the time span. They speculated that differences in P/E ratios between stocks could be explained by 1) project planing growth, 2) expected dividend payout, and 3) the variation in the rate of earnings growth, or growth risk. They concluded that P/E ratio is an increasing function of growth and payout and inversely related to the variation in the growth rate. In other words, higher P/E ratios were associated with higher growth and payout and less variation in growth rate.

Bower and Bower (1969)[15] used a similar approach for a different time period with another sample of firms. They used earnings growth and payout as variables but divided risk into subcomponents, including marketability of stock, its price variability and its conformity with the market. The results indicated the same positive effects of earnings growth and payout. However, their examination of risk was more detailed. They discovered that higher P/E ratios were associated with more rapid earnings growth and higher dividend payout; lower P/E ratios

---

[14] V.S. Whitbeck and M. Kisor, Jr., " A New Tool in Investment Decision-Making ", *Financial Analysts Journal*, Vol.19, 1963

[15] R.S. Bower and D.H. Bower, " Risk and the Valuation of Common Stock ", *Journal of Political Economy*, Vol.77, No.3,1969

with less marketability, greater conformity to parket price movements, and higher price variability.

Malkiel and Cragg (1970)[16] studied the effects of historical growth of earnings, dividend payout ratio, and the stock's rate of return relative to the market in determining P/E ratio. Earnings growth was found to have a positive effect on the P/E. The closer a stock's return followed that of the market, the more negative the P/E effect. The dividend payout effect was not clear; in some years, the higher the payout, the higher the P/E, but this was not true for all these years.

3.2 Research Methodology

The initial section contained a discussion of the related studies. Based upon the prior studies, we hypothesize a significant association between the systematic risk measures for bond and the default risk.

3.2.1 Statement of Hypothesis

This research study will examine the relationship between the systematic risk measures for corporate bonds and the default risk. Systematic risk is the risk associated with changes in returns on securities due to changes in the overall level of such returns. The default risk, being determined by internal corporate factors, is the risk that the average corporation will default on the coupon or principal payment.

However, the default risk is largely systematic in nature because the probability of a default in terms of individual bonds should vary systematically as business conditions vary. The credit rating of a bond reflects the ability of the

---

[16] B.G. Makiel and J.G. Cragg, " Expectations and the Structure of Share Prices ", *American Economic Review*, Vol.60, No.4, 1970

issuer to service outstanding debt obligations. To a large extent, information of this nature is captured in the ratings issued by the firms that rate such bonds. As a result, bonds possessing a different rating have different yields. For example, AAA-rated obligations possess a lower risk of default than BBB obligations, so they can provide lower yield.

The risk premium differences between bonds of different quality levels have changed dramatically over time depending on prevailing economic conditions. When the economy experiences a recession or a period of economic uncertainty, the desire for quality increases, and investors bid up prices of higher-rated bonds, which reduces their yields. It seems clear that there should be a positive relationship between the systematic risk of a bond and the probability of default.

The study will be divided into two parts by using two types of variables to measure the risk of default. First, if we measure default risk by using TRIS's rating class, then the first hypothesis is

H1 : *The systematic risk measures for a bond should be inversely related to the rating of that bond i.e. the higher rating, the lower the systematic risk.*

The second type of variable we used to measure default risk consists of variables that are unique to a particular company. Aware of the difficulty involved in selecting the independent variables, we have attempted to choose approximately the same list of explanatory variables as are commonly found in several other valuation studies.

In this paper, we will analyze the effect of a firm's size as well as its P/E ratio, in conjunction with the ability of the issuer with regard to issuing bonds on the international bond market.

Following is a discussion of the three variables which we used as determinants of default risk.

1. Firm's size is an important determinant of default risk, where large firms are presumed to be less risky. Several theoretical arguments can be advanced in support of this assertion:

Fisher (1959) suggests that large firm's securities represent marketable assets which can be more readily turned into cash, therby being less risky. For the probability of bankruptcy, Altman (1968) states that since large firms do not appear overnight, but rather grow over a period of time into their existing size, and since failing firms tend to disappear in their early years of operation, it follows that the firm's size constitutes a measure of its past performance, and may be indicative of its future performance and its risk.

In the context of portfolio theory, unless returns on individual assets are perfectly correlated, large firms would attain a low variance of overall returns when compared with smaller firms. A lower variance of returns would not necessarily mean lower risk, unless the covariance with market return is also lower. Large firms would be less risky, however, if firms can diversify their operations more efficiently than the individual investor can diversify his own portfolio.

In addition, as scale economies enable firms to incur lower unit costs and consequently earn an above-normal economic rent, the latter can serve as a buffer against losses, thereby reducing the probability of default.

2. The price-earning ratio (P/E) is another determinant of risk. It is the share price divided by the current earning per share. P/E ratio is primarily determined by the riskiness of the firm and the rate of growth in its earnings.

Within the context of direct valuation models, several important studies have emphasized earnings growth and dividend payout as important determinants of P/E ratio. Whitbeck and Kisor , Bower and Bower concluded that P/E is an increasing function fo earnings growth and dividend payout. In other words, higher P/E ratios are associated with higher growth and payout. Therefore, P/E ratio is a measure of the market's confidence in a particular company. A high P/E ratio usually indicates that investor have confidence that profit will grow strongly in future and also it can provide lower probability of default.

3. The ability of the issuer with regard to issuing bond on the international bond market.

As for the ability of the issuer with regard to issuing bonds on the international bond market, we have included this variable in the analysis because there are a number of Thai companies that have issued debentures on the self-same market. The fact that foreign investors have approved the financial status - have faith in the ability of Thai companies indicates the potential of Thai companies in the international marketplace. Therefore, a company which issues debenture on both the domestic and international bond markets should default less than a company which issues debentures on the domestic market only.

All of the companies under study are, therefore, ranked at particular points in time with respect to the following three criteria: the firm's size, its P/E ratio, and its ability with regard to issuing bonds on the international bond market. Hence, the second hypothesis is

H2 : *If a company ranked high with respect to the firm's size, its P/E ratio, and its ability with regard to issuing bonds on the international bond market, we hypothesize that it would have a low systematic risk.*

3.2.2 Data Sets

The following criteria were selected for use in the study :

1. The weekly data of the corporate debentures traded on Bond Dealers' Club which collected from the Manager Information Services (MIS) for the period of February 1995 to September 1996.

2. The Thai corporate debentures issued and traded on the international financial market for the period of 1995 - 1996 which was collected from The Securities and Exchange Commission (SEC).

3. A rating by TRIS's of categories BB+ through AA+ , with all issues maintaining the given rating for the complete period of analysis.

4. No more than one debenture selected from the issuer.

Based on these criteria, 25 debentures were chosen for use in the study :

Debenture		Rating
Symbol	**Corporate**	
1. TFB#1	Thai Farmers Bank	AA+
2. REGCO#2	Rayong Electricity Generating Co.	AA+
3. SCIB#1	Siam City Bank	AA-
4. DS#1	Dhana Siam Finance and Securities	A+
5. FIN1#1	Finance One	A+
6. KK#1	Kiatnakin Finance and Securities	A
7. BANPU#1	Banpu	A
8. UCOM#1	United Communication Industry	A
9. ITD#1	Italian-Thai Development	A
10. SINGER#1	Singer Thailand	A-
11. PERFECT#1	Property Perfect	BBB
12. GF#1	General Finance and Securities	BBB
13. TASCO#1	Tipco Asphalt	BBB
14. PIZZA#1	The Pizza	BBB
15. TM#1	Thai Modern Plastic	BBB
16. NATION#1	Nation Publishing Group	BBB
17. TGCI#1	Thai-German Ceramics Industry	BBB-
18. QH#1	Quality Houses	BBB-
19. SMC#1	Swedish Motors	BB+
20. SITCA#1	Sitca Investment and Securities	Non-rated
21. UNITED#1	United Finance Corporation	Non-rated
22. JULDIS#1	Juldis Develop	Non-rated
23. LH#1	Land and Houses	Non-rated
24. MDX#1	MDX	Non-rated
25. ROBIN#1	Robinson	Non-rated

3.2.3 Methodology

The study will proceed as follows. First, it will estimate the systematic risk (β) for a sample of corporate debentures and next it will regress the estimated β 's on measures of default risk to realize the relationship.

(1). Market Model Estimation

First , the study examines whether or not bond exhibit systematic risk by using the market model which has following assumption ;

1. Individual security returns are related to each other only through a common relationship with the market index.

2. Each security's relationship with the market index is linear.

The model can be expressed algebraically as

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where R_{it} = the return on individual security i during period t

R_{mt} = the market rate of return during period t

α_i = the regression intercept

β_i = the slope coefficient

ε_{it} = the random error term

The beta coefficient (β) is refered to as the measure of a security's systematic risk which can be calculated as

$$\beta_i = Cov_{im} / \delta^2_m$$

Since it is a linear model with one independent variable and one dependent variable, simple linear regression is the empirical methodology used when dealing with the market model.

The sample bond's systematic risk, defined by the beta coefficient, was derived directly from the market model. The beta coefficient values will be determined by using the following market indices

(1) S-ONE market yield

(2) S-ONE bond index

(3) SET index

S-ONE market yield was chosen because the index includes the yield to maturity of all (fixed coupon) corporate debentures. S-ONE bond index served as a market indicator reflecting price development in the market over time. The SET index was employed because it provides a widely-used capital asset index.

Given the period of analysis, it was possible to utilize 75 weekly observations in the determination of each bond's beta value. Then weekly observations for each independent and dependent variable will be computed as monthly return as follows :

1. Yield Measures with S-ONE Market Yield

$$M_t = (Y_t - Y_{t-4}) / (Y_{t-4})$$

where M_t = the return of both individual bond and market for the t th month

Y_t = the bond's yield to maturity for the t th week

Y_{t-4} = the bond's yield to maturity lagged for 4 weeks

2. Price Measures with S-ONE Bond Index and SET Index

$$M_t = (P_t - P_{t-4}) / (P_{t-4})$$

where M_t = the return of both individual bond and market for the t th month

P_t = the bond's price for the t th week

P_{t-4} = the bond's price lagged for 4 weeks

(2). Comparison of Alternative Market Indices

This section contains an analysis of the alternative market indices used in computing the systematic risk measures for corporate bonds. The results from the market model estimation with the three indices are compared to determine which index is superior based on the regression results. Then the best market index will be used in the subsequent analysis of the association between systematic risk and default risk.

(3). Expected Behavior of the Beta Coefficient

This process will examine the effect of default risk on systematic risk or β. The independent variables will be divided into 2 set for each hypothesis testing which designed to measure default risk. In each set, the dependent variable was the estimated β for each bond, which derived from the best model in the process of the comparison of alternative market indices.

(3.1) Testing for the First Hypothesis

We want to test the hypothesis that there is difference in the systematic risk associated with rating in each class and whether or not the systematic risk increase as we move to lower rated bond. Testing for the first hypothesis will be divided into 3 cases as follows :*

Case1

$$B_i = \alpha_0 + \alpha_1 D_i + \varepsilon_i$$

where B_i = the beta coefficient of bond i derived from the market model

D_i = 1 if rating is in group A (range from **A-** to **AA+**)

= 0 if rating is in group B (range from **BB+** to **BBB**)

α_0 represent the expected value or the mean value of systematic risk associated with rating in group B, while α_1 measures the difference in systematic risk associated with a change of rating from group B to group A.

* **There are 19 observations in case1 and case2 , but there are 25 observations in case3 because they include non-rated debentures.**

Case2

$$B_i = \alpha_0 + \alpha_1 D_i + \varepsilon_i$$

where B_i = the beta coefficient of bond i derived from the market model

D_i = 1 if rating is AA+

= 2 if rating is AA-

= 3 if rating is A+

= 4 if rating is A

= 5 if rating is A-

= 6 if rating is BBB

= 7 if rating is BBB-

= 8 if rating is BB+

Case3

$$B_i = \alpha_0 + \alpha_1 D_{1i} + \alpha_2 D_{2i} + \varepsilon_i$$

where B_i = the beta coefficient of bond i derived from the market model

D_{1i} = 1 if rating is in group A (range from **A-** to **AA+**)

0 otherwise

D_{2i} = 1 if rating is in group B (range from **BB+** to **BBB**)

0 otherwise

α_0 represents the mean value of systematic risk associated with non-rated bonds and α_1, α_2 represent the expected value of systematic risk associated with rating in group A and group B respectively.

(3.2) Testing for the Second Hypothesis

Our empircal test is concerned with the relationship between the systematic risk and the firm's size, its P/E ratio, and the ability of the issuer with regard to issuing bonds on the international bond market. We will estimate the parameters of the following model:

$$B_i = \gamma_0 + \gamma_1 FS_i + \gamma_2 PE_i + \gamma_3 X_i + \varepsilon_i$$

where B_i = The beta coefficient of bond i derived from the market model

FS_i = The size of company i (measured by total asset)

PE_i = Price-earning ratio of company i

X_i = 1 if a company issued bonds on both the domestic and international market

= 0 if a company issued bonds only for the domestic market

We expect that if a company issued debentures on both the domestic and international market, the beta coefficient will less than in the case that a company issued debentures on the domestic market only, or the coefficient of dummy variable will be negative. We expect a negative coefficient for the price-earning ratio variable, and we expect the coefficient of the firm's size to be negative.