CHAPTER 4

The Empirical Results

This chapter is the presentation of results which divided into three major parts. The first part is the estimation of the systematic risk for a sample of corporate debentures over the period of the study. The second part contains an analysis of the alternative market indices used in computing the systematic risk measures for corporate bonds. The third part discusses the association between systematic risk measures for bond and the default risk.

4.1 The Market Model Estimation

We estimated the market model regression for each corporate debenture in the sample using monthly return for 71 observations. We report the summary statistic of the regression run with each index in the Table 4.1, 4.2, and 4.3 respectively.

From these results, we can see that a large number of debentures in the model run by using S-ONE market yield (Table 4.1) had statistically significant β 's at 5% level, followed by the model run by using S-ONE bond index (Table 4.2). However, the result of the model run by using SET index was statistically insignificant (Table 4.3).

Most of the debentures had a beta less than 1, this means that it has below-average systematic risk. However, the ITD's beta is higher than 1 (1.076 for S-ONE market yield and 2.744 for S-ONE bond index), it has above-average systematic risk and the ITD would be classified as an aggressive debenture.

Table 4.1 : Market Model Estimation Run with S-ONE Market Yield

Debenture	Statistics						
	Beta	T-Stat	S.E	R^2	D.W	F-Stat	Mean dep.
TFB#1	0.629	5.64	0.015	0.315	0.542	31.814	-0.0045
REGCO#2	0.515	3.224	0.022	0.131	0.831	10.397	-0.0038
SCIB#1	0.603	5.162	0.016	0.279	0.753	26.648	-0.0038
DS#1	0.962	7.427	0.017	0.444	0.475	55.156	-0.0034
FIN#1	0.928	7.245	0.017	0.432	0.513	52.493	-0.0043
BANPU#1	0.811	9.335	0.012	0.558	0.466	87.142	-0.0038
UCOM#1	0.96	5.399	0.017	0.351	0.567	29.152	-0.0004
ITD#1	1.076	6.556	0.015	0.483	0.586	42.986	-0.0074
SINGER#1	0.308	3.079	0.014	0.121	0.571	9.477	-0.0071
KK#1	0.736	3.655	0.019	0.208	0.244	13.361	0.0025
GF#1	0.9	7.593	0.016	0.455	0.573	57.656	-0.0032
TASCO#1	0.564	4.65	0.016	0.239	0.593	21.622	-0.004
TGCI#1	0.854	7.247	0.016	0.432	0.506	52.524	-0.0056
PIZZA#1	0.363	3.021	0.016	0.117	0.851	9.125	-0.0059
PERFECT#1	0.176	0.699	0.025	0.009	1.93	0.488	0.0055
TM#1	0.748	5.323	0.019	0.291	0.286	28.335	-0.003
NATION#1	0.769	6.757	0.015	0.398	0.396	45.655	-0.0039
QH#1	0.614	6.056	0.014	0.347	0.486	36.67	-0.0021
SMC#1	0.482	6.849	0.009	0.405	0.586	46.907	-0.0017
ROBIN#1	0.401	4.285	0.013	0.21	1.321	18.361	-0.0037
SITCA#1	0.622	8.034	0.01	0.483	0.9	64.549	-0.0034
UNITED#1	0.576	5.184	0.013	0.329	1.354	33.806	-0.0022
JULDIS#1	0.603	2.817	0.029	0.103	1.237	7.933	0.0032
LH#1	0.544	4.971	0.015	0.246	1.255	24.707	-0.0033
MDX#1	0.462	4.811	0.013	0.251	1.129	23.142	-0.0007

Table 4.2 : Market Model Estimation Run with S-ONE Bond Index

Debenture	Statistics						
	Beta	T-Stat	S.E	R^2	D.W	F-Stat	Mean dep.
TFB#1	0.449	1.993	0.022	0.054	0.637	3.972	0.0032
REGCO#2	0.442	2.007	0.022	0.055	0.654	4.027	0.003
SCIB#1	0.511	3.271	0.015	0.134	0.496	10.702	0.0069
DS#1	0.384	0.931	0.041	0.012	2.056	0.867	0.0032
FIN#1	0.812	3.331	0.024	0.139	1.754	11.096	0.0074
BANPU#1	0.221	2.193	0.009	0.065	0.71	4.81	0.0064
UCOM#1	-0.346	-0.411	0.075	0.003	1.928	0.169	0.0035
ITD#1	2.744	7.5	0.018	0.55	0.653	56.254	0.0059
SINGER#1	-0.242	-1.657	0.014	0.038	0.524	2.746	0.0022
KK#1	-0.465	-2.138	0.016	0.082	0.765	4.57	0.0004
GF#1	0.241	2.695	0.009	0.095	0.629	7.262	0.0065
TASCO#1	0.205	2.102	0.009	0.06	0.442	4.42	0.0068
TGCI#1	0.365	4.204	0.009	0.204	0.728	17.676	0.0083
PIZZA#1	0.043	0.368	0.012	0.002	0.567	0.135	0.0056
PERFECT#1	-0.19	-1.449	0.012	0.036	1.347	2.098	0.0035
TM#1	0.462	2.716	0.017	0.097	0.636	7.379	0.0044
NATION#1	0.608	4.344	0.014	0.215	0.699	18.814	0.0065
QH#1	0.628	4.653	0.013	0.239	0.793	21.651	0.0066
SMC#1	0.078	0.822	0.009	0.01	0.65	0.676	0.0063
ROBIN#1	-0.103	-0.522	0.02	0.004	0.606	0.272	0.0006
SITCA#1	0.521	4.439	0.012	0.222	0.621	19.708	0.0077
UNITED#1	0.411	1.923	0.021	0.509	0.701	3.697	0.0023
JULDIS#1	-0.196	-0.879	0.022	0.011	1.129	0.723	0.0002
LH#1	0.278	2.287	0.012	0.07	0.612	5.231	0.0056
MDX#1	-0.114	-0.556	0.02	0.004	0.544	0.309	0.0004

Table 4.3 : Market Model Estimation Run with SET Index

Debenture	Statistics						
	Beta	T-Stat	S.E	R^2	D.W	F-Stat	Mean dep.
TFB#1	0.015	0.267	0.023	0.001	0.433	0.072	0.0032
REGCO#2	-0.066	-1.259	0.022	0.022	0.593	1.586	0.003
SCIB#1	0.04	1.017	0.017	0.015	0.336	1.035	0.0069
DS#1	0.021	0.217	0.041	0.001	2.05	0.047	0.0032
FIN#1	0.17	2.914	0.025	0.109	1.609	8.491	0.0074
BANPU#1	-0.011	-0.444	0.01	0.003	0.623	0.197	0.0064
UCOM#1	0.06	0.3	0.075	0.002	1.914	0.09	0.0035
ITD#1	0.052	0.691	0.027	0.011	0.337	0.49	0.0059
SINGER#1	-0.016	-0.459	0.015	0.003	0.475	0.212	0.0022
KK#1	0.023	0.524	0.017	0.005	0.593	0.275	0.0004
GF#1	0.052	2.44	0.009	0.079	0.614	5.954	0.0065
TASCO#1	0.053	2.343	0.009	0.074	0.517	5.489	0.0068
TGCI#1	0.006	0.242	0.009	0.001	0.405	0.059	0.0083
PIZZA#1	-0.004	-0.136	0.012	0.003	0.563	0.018	0.0056
PERFECT#1	-0.009	-0.273	0.012	0.001	1.245	0.074	0.0035
TM#1	0.113	2.839	0.016	0.105	0.455	8.064	0.0044
NATION#1	0.055	1.495	0.015	0.031	0.46	2.234	0.0065
QH#1	0.018	0.508	0.015	0.004	0.431	0.258	0.0066
SMC#1	-0.038	-1.753	0.009	0.043	0.674	3.074	0.0063
ROBIN#1	0.02	0.422	0.019	0.003	0.616	0.178	0.0006
SITCA#1	0.036	1.162	0.013	0.019	0.344	1.351	0.0077
UNITED#1	-0.084	-1.647	0.021	0.038	0.667	2.712	0.0023
JULDIS#1	0.095	1.834	0.022	0.465	1.16	3.364	0.0002
LH#1	0.081	2.871	0.012	0.107	0.648	8.243	0.0056
MDX#1	0.026	0.532	0.02	0.004	0.546	0.283	0.0004

4.2 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 with the three indices are compared to determine which index is the best.

In the comparison of results, several criteria are employed to differentiate between the models :[1]

1. the average standard error of regression
2. the average coefficients of determination
3. the autocorrelation in the residual

We should prefer a model that minimizes the standard error of regression, and maximizes the variance explained. Moreover, it is important to differentiate the results on the basis of the autocorrelation in the residuals. Since a basic assumption of the model is that after the market component is accounted for, the remaining unique returns are independent of prior returns for the asset examined.

The relavant results are contained in Table 4.4. The average standard error of regression for each class of bond indicates that the standard error of regression for the three indices were unsatisfactorily high when interpreted in relation to the mean value of the dependent variable. Hence, the results of the average standard error of regression for both indices were insignificant. The result of three sets were indifferent because the average standard error of regression were quite close.

By using F statistic tested the significance of the coefficients of determinant (R^2) statistic, the F statistic was highly significant at 5% level for

[1] These criteria followed the study of Frank R Reilly and Michael D. Joehnk (1976), ibid.p.1350

each individual debenture in the market model run by using S-ONE market yield, followed by S-ONE bond index and SET index respectively.

Table 4.4 : Comparative Regression Statistics of Alternative Market Indices

Regression Statistics	TRIS Rating	Market Indices		
		S-ONE market yield	S-ONE bond index	SET index
Beta	AA+	0.5720	0.4460	-0.0260
	AA-	0.6030	0.5110	0.0400
	A+	0.9450	0.5980	0.0190
	A	0.9490	0.5390	0.0310
	A-	0.3080	-0.2420	-0.0160
	BBB	0.5860	0.2280	0.0430
	BBB-	0.7340	0.4970	0.0120
	BB+	0.4820	0.0780	-0.0380
	Non-rated	0.5350	0.1330	0.0290
Standard error of regression	AA+	0.0190	0.0220	0.0230
	AA-	0.0160	0.0150	0.0170
	A+	0.0170	0.0330	0.0330
	A	0.0130	0.0300	0.0320
	A-	0.0140	0.0140	0.0150
	BBB	0.0180	0.0120	0.0120
	BBB-	0.0150	0.0110	0.0120
	BB+	0.0090	0.0090	0.0090
	Non-rated	0.0160	0.0180	0.0180

Table 4.4(continued) : Comparative Regression Statistics of Alternative Market Indices

Regression Statistics	TRIS Rating	Market Indices		
		S-ONE market yield	S-ONE bond index	SET index
R^2	AA+	.223(100%)	0.055(100%)	0.012(0%)
(% of significant R^2)	AA-	0.279(100%)	0.134(100%)	0.015(0%)
	A+	0.438(100%)	0.076(50%)	0.055(50%)
	A	0.4(100%)	0.175(75%)	0.005(0%)
	A-	0.121(100%)	0.038(0%)	0.003(0%)
	BBB	0.252(88.33%)	0.084(66.67%)	0.095(50%)
	BBB-	0.39(100%)	0.222(100%)	0.003(0%)
	BB+	0.405(100%)	0.01(0%)	0.043(0%)
	Non-rated	0.27(100%)	0.137(33.33%)	0.106(16.67%)
Autocorrelation		96.15%	88.46%	92.31%

Notes : 1.Beta data, standard error of regression and R^2 are in mean value.

2.Reported autocorrelation figures represent the portion of individual observations with significant autocorrelation.

3.All observations for the mean and percentage values were obtained from the result of the market model regression.

The results of the comparison of R^2 among three indices indicates that the average R^2 for the model which used S-ONE market yield was significantly higher than that used S-ONE bond index and SET index.

As for the autocorrelation results, the regressions which used the S-ONE market yield had highest proportion of regression with significant autocorrelation, as compared to about 92.31% of SET index and 88.46% of S-ONE bond index.

Overall, we could not cleary differentiate between S-ONE market yield and S-ONE bond index. Based upon the regression statistics, there was no difference in terms of the standard error of regression. While the R^2 result prefered the S-ONE maket yield, but the autocorrelation results favoured the S-ONE bond index.

However, in terms of R^2, the S-ONE market yield was clearly superior because the coefficients of determinations were always higher. The regression results showed almost no difference in autocorrelation between both indices because the percentage of autocorrelation in the model which used S-ONE bond index was slightly superior to the S-ONE market yield. Hence, the S-ONE market yield will be used in the subsequent analysis of the association between systematic risk measures for bonds and default risk.

4.3 The Association Between the Systematic Risk Measures for Bonds and the Default Risk

There are two tests of the association between the systematic risk measures for bond and the default risk. The first is an analysis of the relationship between bond's beta and bond ratings. The second is an analysis of the relationship between bond's beta and the variables that are unique to a particular company.

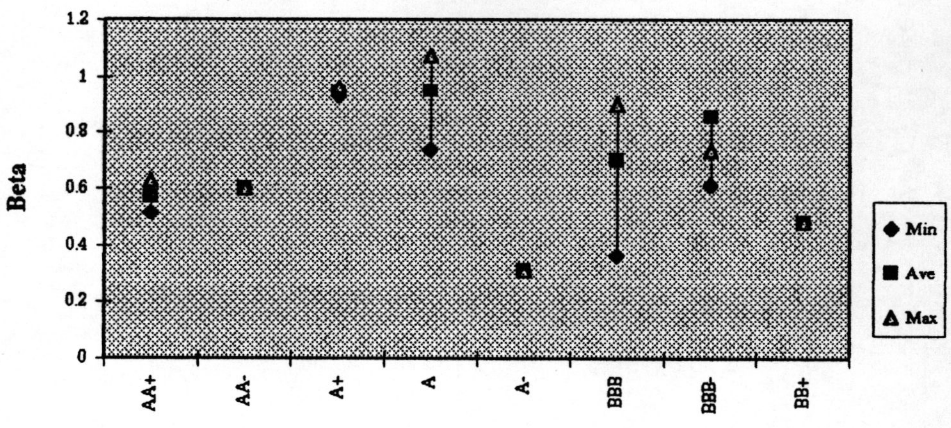
4.3.1 The Association Between the Systematic Risk Measures for Bonds and Bond Ratings

We hypothesized a significant difference between rating classes, we would expect the lowest average beta for the sample of AA+ debentures, with a consistent increase to the BB+ debentures. The results are contained in Table 4.5

Table 4.5 : Comparative Behavior of Betas Relative to TRIS Rating

TRISRating	No. of Debentures		Beta		
	No.	%	Max.	Min	Average
AA+	2	8	0.629	0.515	0.572
AA-	1	4	-	-	0.603
A+	2	8	0.962	0.928	0.945
A	4	16	1.076	0.736	0.949
A-	1	4	-	-	0.308
BBB	6	24	0.900	0.363	0.700
BBB-	2	8	0.845	0.614	0.734
BB+	1	4	-	-	0.482
Non-rated	6	24	0.622	0.401	0.535

Chart 4.1 : Comparative behavior of betas relative to TRIS rating



The trend of betas for S-ONE market yield regression was generally in the wrong direction. The relative size of betas was consistent with expectations for the top four rating classes. In contrast, the relative size of betas for the bottom four ratings were not in the hypothesized direction.

Testing for the first hypothesis, the question is whether or not the rating dummy makes a significant contribution toward explaining cross-sectional variation in β. The regression results of 3 cases are as follows (t-statistics in parentheses) :

Case1

$$\hat{B} = 0.608 + 0145D \qquad (4.1)$$

$$(7.602) \quad (1.319)$$

$$R^2 = 0.093 \qquad \text{F-Stat} = 1.740$$

The dummy variable is insignificant at the 5 percent level ($t_{critical}$=2.101), allowing us to accept the null hypothesis that $\alpha_1 = 0$. This means that there is no difference in the systematic risk associated with rating in group A and group B. Therefore, we can conclude that the dummy coefficient have no relation to rating.

Case2

$$\hat{B} = 0.794 - 0.024D \qquad (4.2)$$

$$(5.458) \quad (-0.821)$$

$$R^2 = 0.038 \qquad \text{F-Stat} = 0.674$$

We accept the hypothesis that there is no differences in betas associated with rating ineach class because the dummy variable is insignificant at the 5 percent level ($t_{critical}$=2.101).

Case3

$$\hat{B} = 0.535 + 0.218D1 + 0.073D2 \qquad (4.3)$$

$$(6.110) \quad (1.971) \quad (0.647)$$

$$R^2 = 0.166 \qquad \text{F-stat} = 2.193$$

The dummy variables are insignificant at the 5 percent level ($t_{critical}$=2.069). The F statistic is insignificant at the 5 percent level ($F_{2,23}$=3.42), allowing us to accept the null hypothesis that the regression coefficients α_1 and α_2 are equal. This indicates that there is no differences in the systematic risk associated with rating in group A and Group B.

In summary, the S-ONE market yield regression did not support the first hypothesis. The results indicate no significant relationship between systematic risk measures for bond and bond ratings.

4.3.2 The Association Between the Systematic Risk Measures for Bond and Unique Company-Related Variables

The empirical results of the relationship between betas and the three variables are as follows (t-statistic in parentheses)

$$\hat{B} = 0.5319 + 8.88E\text{-}08FS + 0.0033\, PE + 0.0764X \qquad (4.4)$$
$$(4.249) \quad (0.251) \quad (0.773) \quad (0.744)$$

$$R^2 = 0.062 \qquad F\text{-stat} = 0.463$$

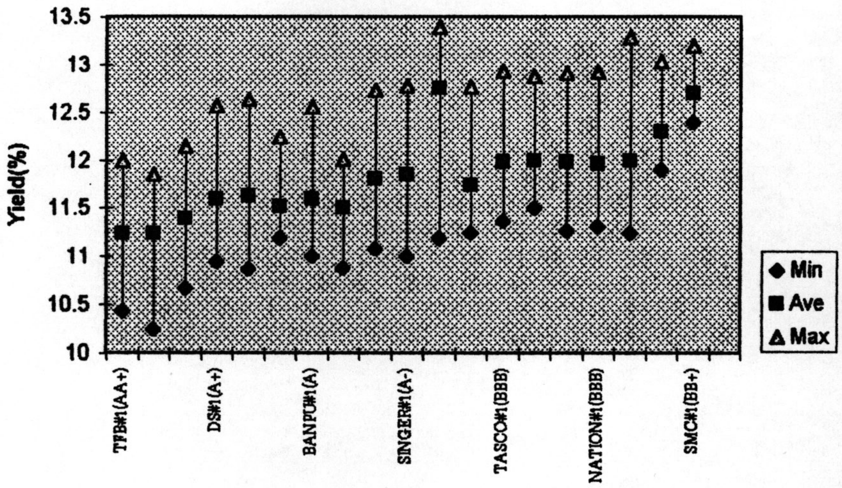
All estimated coeficients are insignificant at 5 percent level, since all t-statistics were less than the critical value ($t_{critical}$=2.069). The F statistic is insignificant at 5 percent level ($F_{3,22}$=3.05), therefore, we can conclude that all of the independent variables did not have effect on the systematic risk measures for bond.

4.3.3 Reasons for Lack of Relationship

The expected relationship did not emerge because this paper is limited by the number of debentures. There were a few debentures traded on the Thai bond market during the period in which this study was undertaken and there were a few debentures in each rating class. Hence, it did not reflect the real average betas in each rating class. Moreover, this paper, focusing as it did on the movement of bond prices and the yield on such bonds, covered the years 1995 and 1996 because the organized secondary market had just been established prior to that. The findings, therefore, cover a limited time period only.

In addition, the credit risk factor has not been fully appreciated by investors. For example, KK#1 (A rated) has lower yield than FIN1#1 (A+ rated).(see Chart 4.2). This occurs because there is an imbalance in the supply and demand of debentures. Strong demand can sometimes push yields down. Therefore, TRIS rating has not been accurately reflected prices and yields.

Chart 4.2 : Yield range of rated debenture



Assigned bond ratings are intended to indicate the relative quality of the bond. The rating assigned to a bond is an indication of the probability of default inherent in the bond based upon the financial and operating attributes of the company, and characteristics of the bond itself. In contrast, the systematic risk is depend on the relationship of bond yield or price changes and changes in market yield or market price. While the level of bond yields are influenced by the economics conditions and issue characteristics that determine the rate of return on a bond. In short-run, unique company-related variables are rather stable. Therefore, the major factors that influence short-run price or yield changes are macroeconomic variables, such as changes in aggregate riskless rate of interest and changes in expectations regarding inflation.

The real risk-free rate of interest is the economic cost of money, that is , the oppotunity cost necessary to compensate individuals forgoing consumption. The expected rate of inflation is the other economic influence on bond yields. We add the expected level of inflation to the real risk free rate of interest to specify the nominal aggreate riskless rate of interest. These significant macroeconomic factors will have approximately the same effect on all bonds. This infer that all yields will move together and, therefore, bonds will have similar systematic risk, irrespective of issue characteristics or bond ratings.