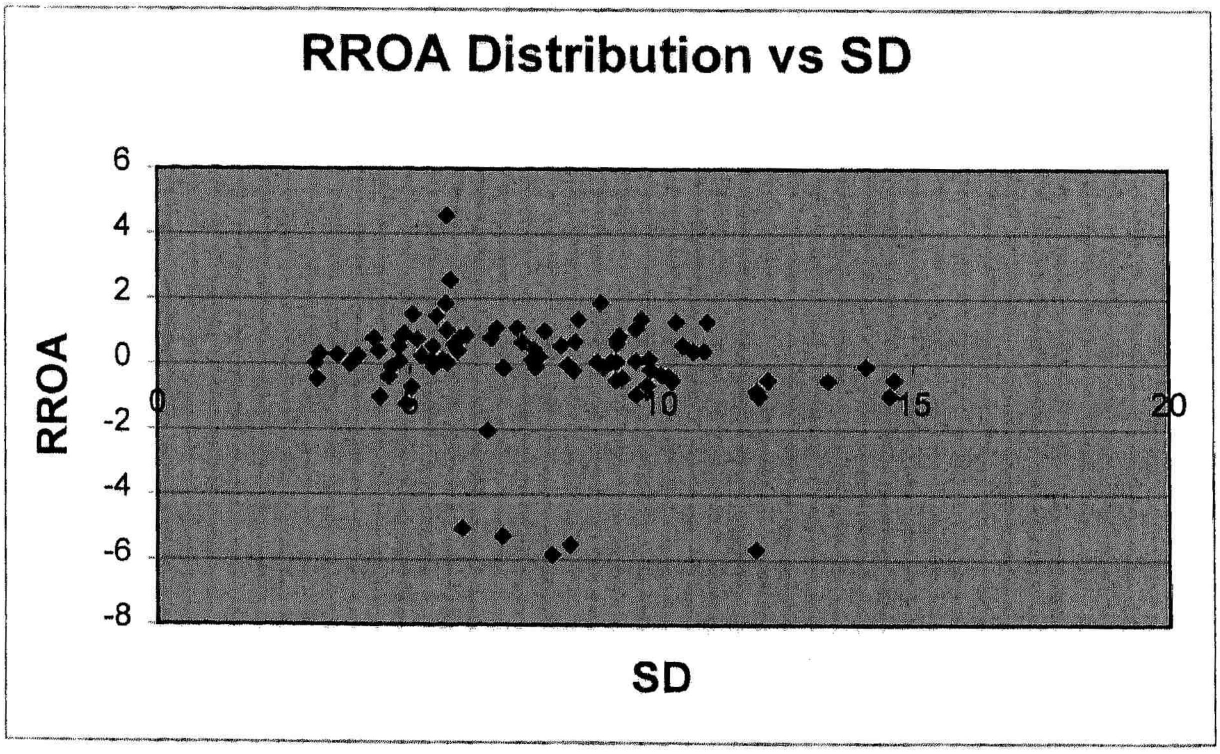
CHAPTER 4 : RESEARCH RESULTS

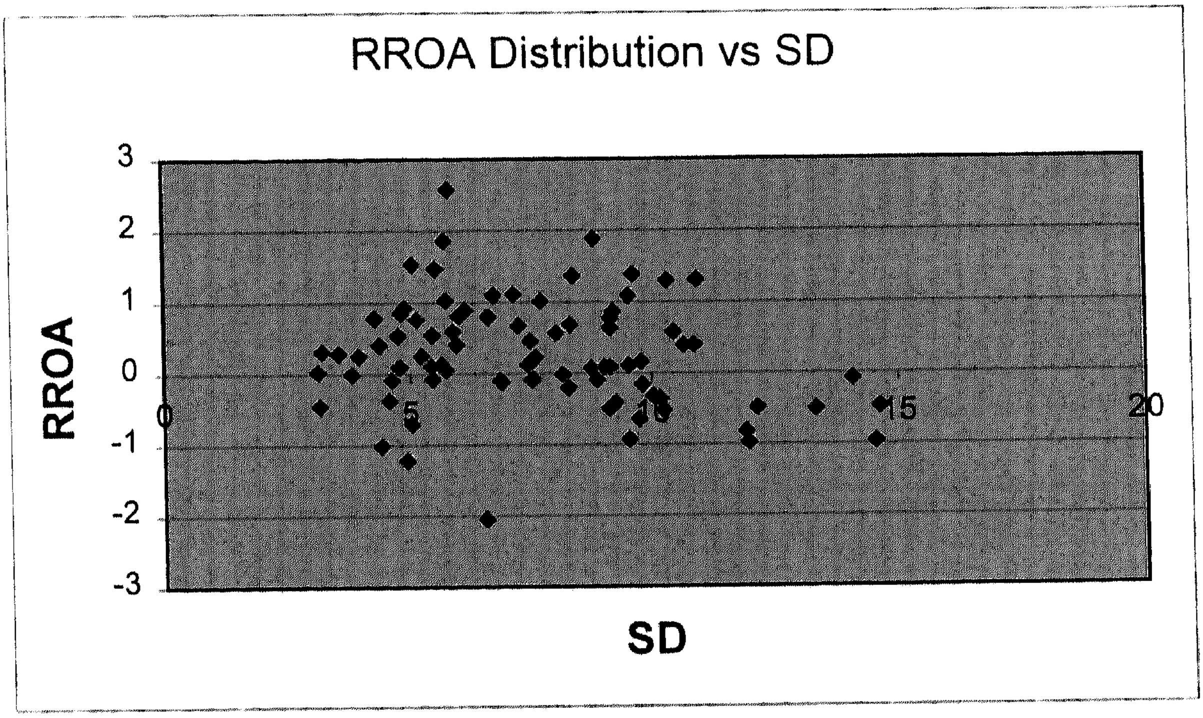
4.1 Summary Statistics of Sampling and Data Collection

As shown Appendix1, there are one hundred and twenty seven (127) data set in sampling frame, due to merging exercises, the number of data set for each year decrease towards year 2000. One hundred and ten (110) data sets have been collected with seventeen (17) data set missing (or not available in the market), which is equivalent to 87% of total data set in sampling frame. The major set back is none of the annual data of Bank Bumiputera Malaysia and Sime Bank Berhad collected which account for more than 50% of total missing data set

The twenty (20) data sets collected for year 1995 were only used to derive the first lagged variable for following year, hence the actual number of data set available for the models is ninety (90) data set. The RROA distribution vs SD is plotted as below: -



Preliminary screening has been carried out on the distribution of dependent variable RROA. A range has been designed with mean of RROA as center of the range to identify the "unusual" RROA. The lower range is mean minus three times standard deviation of RROA. The upper range is mean plus three times standard deviation of RROA. Six (6) data sets found outside the range were further dropped from the study.



The final number of data set used in the study is eighty four (84) data sets which are plotted in the above scatter diagram. In this study, model 3 consists most independent variables with maximum number of independent variables of six (6). As rule of thumbs, minimum 10 data sets are required for every independent variable to facilitate efficient/accurate multiple regression analysis (Wesolowsky, 1976). Hence, the eighty four (84) data sets are adequate to meet the minimum requirement in this study.

4.2 Analysis of Measures

Statistical Properties of Variables

The means, standard deviations and correlations among the variables are tabulated as below: -

Variables	Means	Standard Deviation	Correlations						
			RROA	MS	EFF	MG	RLAG	SD	SD^2
RROA	0.2713	0.7690	1.000						
MS	0.0433	0.0052	0.340	1.000					
EFF	-0.0558	0.0188	-0.137	0.097	1.000				
MG	0.0077	0.0985	-0.443	-0.150	0.102	1.000			
RLAG	7.5639	1.6152	0.332	0.208	-0.120	-0.072	1.000		
SD	7.5639	2.7473	-0.204	-0.223	0.180	-0.021	-0.178	1.000	
SD^2	64.6706	46.2991	-0.250	-0.235	0.185	-0.017	-0.171	0.981	1.000

Variables	Number of Data Set	Significance of Correlations						
		RROA	MS	EFF	MG	RLAG	SD	SD^2
RROA	84	-						
MS	84	0.001	-					
EFF	84	0.108	0.189	-				
MG	84	0.000	0.087	0.177	-			
RLAG	84	0.001	0.029	0.138	0.258	-		
SD	84	0.031	0.021	0.051	0.424	0.053	-	
SD^2	84	0.011	0.016	0.046	0.440	0.060	0.000	-

The correlations between dependent variable (RROA) and all other independent variables were significant at 0.05 level except variable EFF.

The positive correlation between RROA and MS; RROA and RLAG were consistent with expectation. The negative correlations between RROA and EFF; RROA and MG were contradicted with expectation. The negative correlation between RROA and SD implied signal of support for hypothesis 2. The negative correlation between RROA and SD^2 implied signal of support for hypothesis 3.

The strong correlation of 0.981 at 0.000 significance level between SD and SD^2 suggested that multicollinearity needs to be examined in Model 3.

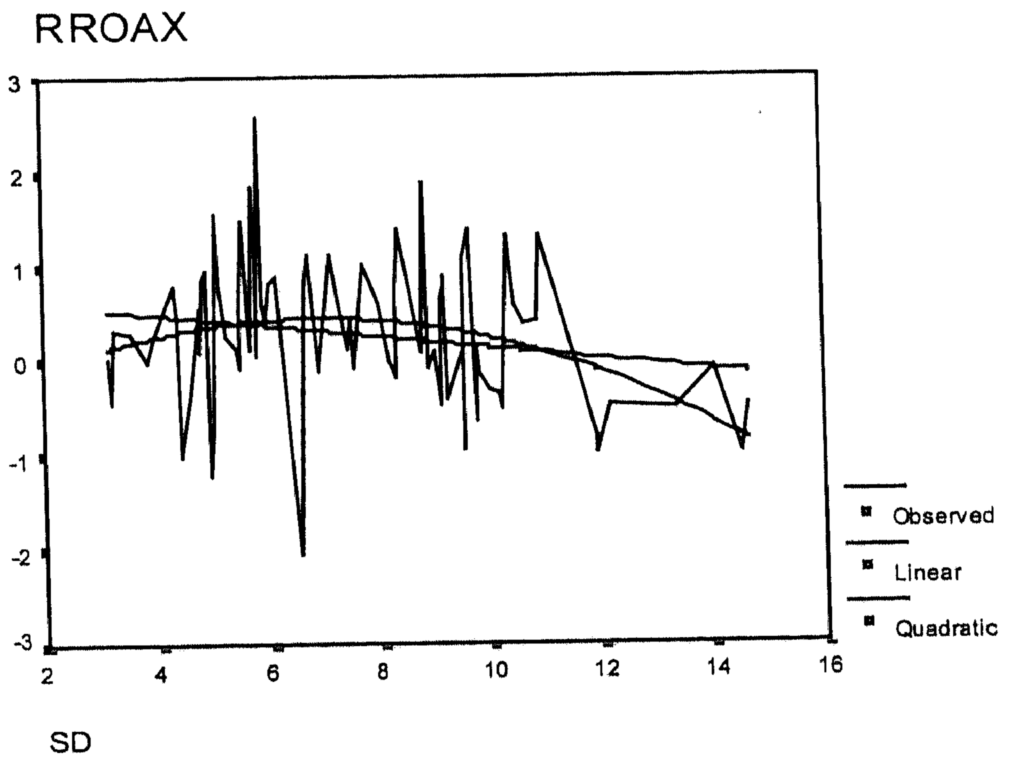
Linear and Curvilinear Relationship between RROA and SD

Two separate linear regression analyses were carried out to provide preliminary examination on linear and curvilinear relationship between RROA and SD. The results are shown in Appendix 2 and summarized as below:-

Model	R	R^2	Standard Error of Estimates	F-Test		Linear Coeff.		Curvilinear Coeff.	
				F	Signif.	Coeff.	Signif.	Coeff.	Signif.
Linear Relationship	0.204	0.042	0.7574	3.563	0.063	-0.057	0.063	NA	NA
Curvilinear Relationship	0.25	0.063	0.7491	5.469	0.022	NA	NA	-0.0042	0.022

By comparing the above R^2, standard error of estimates and F-test results, the preliminary analysis indicated stronger curvilinear relationship, which has better fitness to the data sets. The negative curvilinear coefficient of –0.0042 was significant at 0.022 level implied high possibility of existence of inverted U-shape relationship as stated in hypothesis 3.

The following figure generated using SPSS curve-estimation regression shows the linear and curvilinear relationship between RROA and SD: -



4.3 Hierarchical Regression Analyses : Testing of the Models

Hierarchical regression analyses were carried out for model 1, model 2 and model 3 using the original data sets. The SPSS computer outputs are shown in Appendix 3. Based on the outputs, it was found that Durbin-Watson statistics were relatively low for all three models indicated existences of autocorrelation phenomena. The iterative approach suggested by Wesolowsky (1976) was used to rectify the phenomena, all models met the Durbin-Watson statistic requirement after third step of iteration process. The Durbin-Watson statistics before and after the treatment are tabulated below: -

Model	Durbin-Watson Statistics		d_u	Remarks
	Before Treatment	After Treatment		
1	0.660	1.717	1.60	Low correlation (less than 0.45 between original and treated data sets)
2	0.675	1.706	1.63	Low correlation (less than 0.45 between original and treated data sets)
3	0.769	1.703	1.63	Low correlation (less than 0.45 between original and treated data sets)

Low correlations were found between original and treated (after 3 steps of iterative process) data sets. This indicated that the original data have been distorted significantly and the end result after treatment may not be able to reflect the actual relationship of the models, hence the treatments were dropped to restore the original characteristics of the data sets.

The residual distributions were plotted as shown in Appendix 4 to check whether there was any possible relationship between residual and variables. Based on the plots, weak to moderate heteroscedascity phenomena were found in model 2 and model 3 associated with variable SD and SD^2 respectively. Preliminary weighted least square analyses follow SPSS approaches found increases in standard error of estimates, so SPSS approach was dropped from the treatment process. Wesolowsky's (1976) approach of weighted least square regression using variable SD and SD^2 with power of 1 for model 2 and model 3 respectively were carried out. The outputs after treatment as shown in Appendix 5 indicated slight improvement on Durbin-Watson statistics and condition indexes with weak distortion effects. However heteroscedascity phenomena still existed after the treatment as shown in Appendix 6.The analysis results were summarized for further elaboration.

Condition indexes from the analyses of each model were examined and tabulated as below: -

Model	Date Sets	Condition Index
1	Original	8.645
2	Original	12.839
3	Original	40.869
2	Weighted using SD	14.159
3	Weighted using SD^2	39.468

From the above tabulated, only weak degrading effects in model 1 and model 2 were observed. Model 3 encountered weak to moderate degrading effect mainly due to the presence of second order of strategic variable (SD^2) which was highly correlated with first order of strategic variable (SD). In general, the condition indexes from the analyses of the models were acceptable, hence no further treatment required.

4.4 Summary of Research Results

Five sets of SPSS analyses results were selected for further evaluation, three sets of analyses results were generated from each model analysis using original data sets, the other two were generated from model 2 and model 3 using treated data sets for heteroscedascity phenomena.

Fitness of Model

The analysis parameters for the evaluation of fitness of each model are tabulated below: -

Model	Status Of Data Sets	R	R^2	Standard Error of Estimates	Durbin Watson Statistics	Maximum Condition Index	F-Test	
							F	Signif.
1	Original	0.586	0.344	0.6384	0.66	8.645	10.356	0.000
2	Original	0.596	0.355	0.6372	0.675	12.839	8.58	0.000
2	Weighted (1/SD)	0.671	0.45	0.081	0.982	14.159	12.28	0.000
3	Original	0.639	0.409	0.614	0.769	40.869	8.87	0.000
3	Weighted ($1/SD^2$)	0.665	0.443	0.015	1.234	39.468	9.8	0.000

The F-test results of all the model estimates were significant at 0.001 level, it indicated that the estimated linear relationship of the models were not due to chance. The moderate level of R^2 (coefficient of determination) of all models with highly significant F-test results indicated that the number of data sets were adequate for the regression analyses.

The fitness of model measured by parameter R^2, R and standard error of estimates indicated that model 3 has better fitness than model 2 which in turn has better fitness than model 1.

Durbin-Watson statistics of the model indicated that autocorrelation phenomena decrease in the order of model 1, model 2 and model 3.

Condition indexes of the models indicated that model 3 has most degrading effect of multicollinearity with the inclusion of second order of strategic variable (SD^2). This was due to the high correlation between SD and SD^2 as stated in Section 4.2.

Estimates of Control Variables

The coefficients of control variables computed for each model are tabulated below: -

Model	Status Of Data Sets	MS Coefficient		EFF Coeeficient		MG Coefficient		RLAG Coeffiecient	
		Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.
1	Original	3.552	0.013	-3.76	0.326	-2.967	0.000	0.116	0.011
2	Original	3.174	0.03	-2.869	0.462	-3.04	0.000	0.11	0.017
2	Weighted (1/SD)	1.56	0.211	-7.457	0.053	-2.507	0.000	0.233	0.000
3	Original	2.827	0.045	-2.25	0.55	-3.036	0.000	0.115	0.01
3	Weighted ($1/SD^2$)	1.474	0.258	-7.612	0.085	-2.236	0.000	0.258	0.000

All the coefficients of control variables having consistent sign for all models, it indicated that these coefficients estimates were reliable. With model 1 represents the baseline model for control variables, the consistency of the sign (with added variable SD in model 2 and SD^2 model 3) indicated that no obvious multicollineairty phenomena in these coefficients estimates, because sign of coefficients will change by adding new variable if strong degrading effect of multicollinearity exists.

The estimates for coefficient of MG and RLAG were significant. The estimates for coefficient of MS and EFF were not significant. The sign of MS and RLAG coefficients were positive as expected. The negative sign of MG and EFF coefficients were opposite of what was expected.

Estimates of Strategic Variable

The coefficients of strategic variables computed for each model are tabulated below:

-

Model	Status Of Data Sets	SD Coefficient		SD^2 Coefficient	
		Coeff.	Signif.	Coeff.	Signif.
1	Original	NA	NA	NA	NA
2	Original	-0.031	0.255	NA	NA
2	Weighted (1/SD)	0.019	0.451	NA	NA
3	Original	0.296	0.022	-0.02	0.01
3	Weighted ($1/SD^2$)	0.218	0.152	-0.0139	0.261

The changing sign of SD coefficient from model 2 (original) to model 3 (original) indicated multicollineairty phenomena in this estimate, this was due to the high correlation between SD and SD^2 as stated earlier and increase in variables in the model. Because of multicollinearity, the coefficient of relationship changed even though R^2 changed only slightly.

The significant level for most of the coefficients estimates were low even though R^2 is highly significant, this can be explained with the existence of multicollinearity phenomena because the degrading effects increase standard error of coefficients (Wesolowsky, 1976).

The significance of estimates for coefficients of SD and SD2 deteriorated using weighted least square for the estimates. The estimate for SD^2 coefficient was negative and at better significant level than SD coefficient.