CHAPTER 4

RESULTS

4.1 Chapter Outline

The performance of the portfolios formed using Graham's stock selection criteria was compared to the market performance using the portfolio returns and risk-adjusted returns. The findings are presented in sections 4.2 and 4.3 respectively. Section 4.4 discusses the findings for the comparison of portfolios using different strategies.

4.2 Efficacy of Graham's Stock Selection Criteria Using the Portfolio Returns

Table 4.1 presents the returns of the sampled portfolios using 4 different strategies. On the average, all the strategies except strategy 4 provide returns in excess of the market returns. For the period of study, strategy 1 records the highest mean return (43.48%), followed by strategy 2 (36.06%), strategy 3 (25.34%) and strategy 4 (16.12%). In addition, the market records a mean return of 23.41% which is only slightly higher than that recorded by strategy 4.

An investor, on the average, would achieve a mean return of about 43% using strategy 1 which is almost twice the mean market return of about 23%. Following the Graham-Rea

approach (strategy 3), an investor would achieve a mean return of about 25%, which is slightly higher than the mean market return.

These findings suggest that the portfolios formed from Graham's stock selection criteria do gain superior returns. In fact, changing the strategy increases the mean portfolio returns except for strategy 4.

Table 4. 1 Returns of the Market and the Sampled Portfolios

Portfolio	Portfolio Returns (%) for Strategy				
Holding Period	1	2	3	4	Market
4/88 – 3/90	88.94	75.51	59.32	36.29	104.00
4/89 – 3/91	65.27	55.15	43.58	28.75	43.30
4/90 – 3/92	19.77	19.98	17.58	13.66	1.60
4/91 – 3/93	26.76	24.54	20.29	17.97	9.57
4/92 – 3/94	111.18	93.17	73.38	46.45	60.60
4/93 – 3/95	119.91	97.37	64.10	32.70	52.98
4/95 – 3/97	30.16	31.10	23.33	19.48	22.26
4/96 – 3/98	-41.79	-41.79	-41.79	-13.92	-37.38
4/97 – 3/99	-48.01	-48.01	-48.01	-48.01	-58.21
4/98 – 3/00	62.56	53.60	41.66	27.82	35.42
Average	43.48	36.06	25.34	16.12	23.41

To test the efficacy of the selection criteria, the method of a matched pairs experiment was used. In addition, the Kolmogorov-Smirnov test was employed to check the normality condition. The results of these tests are summarised in Table 4.2

Table 4. 2 Results of Tests Using the Portfolio Returns

Test Statistic	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Paired Samples Test	2.621**	2.035**	0.347	-0.908
Kolmogorov-Smirnov Test	0.585	0.706	0.830	0.647

** Significant at 5%

The Kolmogorov-Smirnov test does not provide any evidence of non-normality of the paired differences, indicating that the results of the paired samples test is reliable. Results of the paired samples test show that portfolio returns using strategies 1 and 2 are significantly greater than the market return at 5% significance level. However, there is no significant difference in the portfolio returns of strategies 3 and 4 and the market. Therefore, conclusion can be made that portfolios formed from Graham's stock selection criteria do outperform the market. In addition, such an achievement can be made by changing the strategy to strategy 1 or 2.

4.3 Efficacy of Graham's Stock Selection Criteria Using Risk-Adjusted Returns

The efficacy of Graham's stock selection criteria was further tested using the risk-adjusted returns derived from the Capital Asset Pricing Model as mentioned in section

3.5.2. The term, α_p, is an estimate of the performance of a security not accounted for by either the security's risk or the market return. Thus, if the selection criteria have selective ability, then α_p would be statistically significant. The findings are presented in Tables 4.3 through 4.6.

The results indicate that, from a return and wealth perspective, the portfolios formed using Graham's selection criteria have an advantage over the market index. Regardless of the strategies used, all the portfolios maintain positive excess risk-adjusted returns ($\hat{\alpha}_p$) throughout the period of study except for the portfolio with holding period from April 1996 to March 1998.

However, few of the excess risk-adjusted returns are statistically significant. For strategies 2, 3 and 4, only three out of the ten excess returns are significant at 1%, 5% or 10% level of significance. Similarly, only four out of the ten excess returns for strategy 1 are significant. For all the strategies, these significant excess returns are from portfolios with holding periods from April 1989 to March 1991, April 1992 to March 1994 and April 1993 to March 1995, plus the holding period from April 1988 to March 1990 for strategy 1.

Table 4. 3 Risk-Adjusted Measures of Strategy 1

Holding Period	$\hat{\alpha}_p$	$t(\hat{\alpha}_p)$	$\hat{\beta}$	$t(\hat{\beta})$	R^2
4/88 – 3/90	0.0083	1.5258*	0.6624	6.9100	0.6846
4/89 – 3/91	0.0143	3.7027***	0.3259	6.4918	0.6570
4/90 – 3/92	0.0014	0.2441	0.6221	7.9026	0.7395
4/91 – 3/93	0.0063	1.0439	0.6585	3.9904	0.4199
4/92 – 3/94	0.0237	2.6424***	0.5966	5.5707	0.5852
4/93 – 3/95	0.0293	2.4934**	0.4117	3.3074	0.3321
4/95 – 3/97	0.0048	0.5578	0.8605	4.2580	0.4518
4/96 – 3/98	-0.0015	-0.1237	1.0208	8.6936	0.7745
4/97 – 3/99	0.0082	0.6256	0.9121	10.3110	0.8285
4/98 – 3/00	0.0152	1.2436	0.8207	9.5764	0.8065

* Significant at 10%
** Significant at 5%
*** Significant at 1%

Table 4. 4 **Risk-Adjusted Measures of Strategy 2**

Holding Period	$\hat{\alpha}_p$	$t(\hat{\alpha}_p)$	$\hat{\beta}$	$t(\hat{\beta})$	R^2
4/88 – 3/90	0.0056	0.9811	0.6708	6.6036	0.6647
4/89 – 3/91	0.0122	3.3354***	0.3130	6.5961	0.6642
4/90 – 3/92	0.0016	0.2946	0.6192	8.5441	0.7684
4/91 – 3/93	0.0055	0.9471	0.6566	4.1707	0.4415
4/92 – 3/94	0.0217	0.2221**	0.4917	4.2272	0.4482
4/93 – 3/95	0.0253	2.3604**	0.3255	2.8707	0.2725
4/95 – 3/97	0.0050	0.6076	0.8477	4.3528	0.4627
4/96 – 3/98	-0.0015	-0.1237	1.0208	8.6936	0.7745
4/97 – 3/99	0.0082	0.6256	0.9121	10.3110	0.8286
4/98 – 3/00	0.0129	1.0218	0.8017	9.0880	0.7897

** Significant at 5%
*** Significant at 1%

Table 4. 5 Risk-Adjusted Measures of Strategy 3

Holding Period	$\hat{\alpha}_p$	$t(\hat{\alpha}_p)$	$\hat{\beta}$	$t(\hat{\beta})$	R^2
4/88 – 3/90	0.0046	0.8427	0.5543	5.7470	0.6000
4/89 – 3/91	0.0100	3.0742***	0.2640	6.2507	0.6398
4/90 – 3/92	0.0009	0.1825	0.5925	8.8180	0.7795
4/91 – 3/93	0.0049	1.0337	0.5347	4.1163	0.4351
4/92 – 3/94	0.0184	2.3165**	0.3463	3.6646	0.3791
4/93 – 3/95	0.0190	2.0855**	0.1562	1.6221	0.1068
4/95 – 3/97	0.0031	0.4247	0.8092	4.6296	0.4935
4/96 – 3/98	-0.0015	-0.1237	1.0208	8.6936	0.7745
4/97 – 3/99	0.0082	0.6256	0.9121	10.3110	0.8285
4/98 – 3/00	0.0097	0.7930	0.7863	9.1685	0.7926

** Significant at 5%
*** Significant at 1%

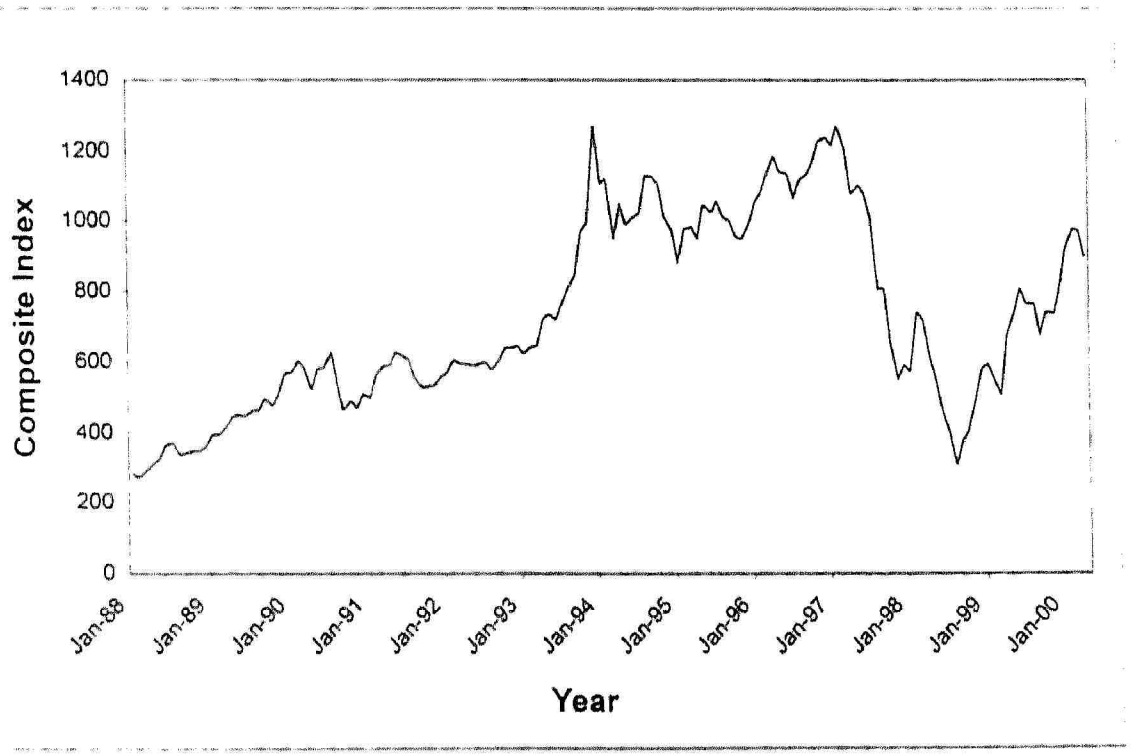
Table 4. 6 Risk-Adjusted Measures of Strategy 4

Holding Period	$\hat{\alpha}_p$	$t(\hat{\alpha}_p)$	$\hat{\beta}$	$t(\hat{\beta})$	R^2
4/88 – 3/90	0.0035	0.6608	0.3281	3.5091	0.3589
4/89 – 3/91	0.0066	2.0977**	0.1921	4.6896	0.4999
4/90 – 3/92	0.0007	0.1690	0.4996	9.4242	0.8015
4/91 – 3/93	0.0043	1.0829	0.5048	4.6451	0.4951
4/92 – 3/94	0.0129	1.7619**	0.1841	2.1013	0.1672
4/93 – 3/95	0.0114	1.6551*	0.0814	1.1193	0.0539
4/95 – 3/97	0.0022	0.3686	0.6596	4.6534	0.4960
4/96 – 3/98	0.0020	0.2181	0.6140	6.8760	0.6824
4/97 – 3/99	0.0082	0.6256	0.9121	10.3110	0.8285
4/98 – 3/00	0.0064	0.5430	0.6684	8.0772	0.7478

* Significant at 10%
** Significant at 5%

The line graph of the KLCI (Figure 4.1) shows that the market experienced a distinct upward movement from the end of 1988 to the beginning of 1990 as well as a steep upward movement from the end of 1992 to the beginning of 1994. These periods of upward movements coincide with the holding period of portfolios exhibiting significant excess risk-adjusted returns. This suggests that portfolios formed from Graham's criteria outperform the market only when the market experiences a distinct upward swing on the average for at least eight months out of the holding period of twenty four months. The portfolios formed do not outperform the market during downturn or stable market.

Figure 4. 1 Line Graph of Monthly KLCI from January 1988 to April 2000



In measuring the performance of portfolios using risk-adjusted return, the OLS regression was run to estimate and test the parameter α_p. This OLS method is valid under the condition that the residuals are independently distributed and from a normal distribution with homoscedastic variance. The Jarque-Bera, White and Durbin-Watson *d* tests were used to test these required conditions and the results are shown in Tables 4.7 through 4.9.

The Jarque-Bera test reveals that all the residual series do not violate the normality condition for portfolios using strategy 1. Only few of the residual series for portfolios purchased in 1993 using strategies 2, 3 and 4 show departure from normality at 1% level of significance.

The White's test shows that few of the residual series suffer from heteroscedasticity at 1%, 5% or 10% level of significance. This implies that only few of the standard errors of the unbiased coefficient estimates are overestimated. Therefore, in general, the *t* tests can be considered to be reliable.

The Durbin-Watson test shows that very few of the residual series are dependent at 1% or 5% level of significance. In addition, the test reveals inconclusive evidence of autocorrelation at 5% level of significance for a few of the residual series. On the average, the Durbin-Watson test does not reveal severe cases of autocorrelation.

Table 4. 7 Jarque-Bera Test for Normality of Residuals

Portfolio Holding Period	Jarque-Bera Test Statistic			
	Strategy 1	Strategy 2	Strategy 3	Strategy 4
4/88 – 3/90	0.0959	1.2022	4.4093	8.3342**
4/89 – 3/91	0.7847	0.5506	0.5957	2.4396
4/90 – 3/92	1.6420	1.5023	0.8235	0.5437
4/91 – 3/93	1.1050	1.0265	1.0450	0.5028
4/92 – 3/94	3.1071	7.9789**	1.8912	2.1600
4/93 – 3/95	4.1644	12.5767***	41.0189***	62.6901***
4/95 – 3/97	2.8476	2.7717	4.2363	3.3794
4/96 – 3/98	0.3339	0.3339	0.3339	1.0754
4/97 – 3/99	0.7094	0.7094	0.7094	0.7094
4/98 – 3/00	1.4049	0.4239	0.4644	5.4595*

* Significant at 10%
** Significant at 5%
*** Significant at 1%

Table 4. 8 White's Test for Homoscedasticity of Residuals

Portfolio Holding Period	Test Statistic			
	Strategy 1	Strategy 2	Strategy 3	Strategy 4
4/88 – 3/90	8.1921**	11.0914***	11.1483***	8.2008**
4/89 – 3/91	2.3449	2.0818	2.2967	0.9918
4/90 – 3/92	3.7140	6.9059**	9.9384***	12.0844***
4/91 – 3/93	1.6410	1.9119	3.7102	8.9167**
4/92 – 3/94	0.3608	1.0922	1.5679	2.5698
4/93 – 3/95	1.7728	1.4915	0.9422	1.6918
4/95 – 3/97	1.3778	1.4618	1.3281	2.8933
4/96 – 3/98	2.7177	2.7177	2.7177	2.9648
4/97 – 3/99	1.7153	1.7153	1.7153	1.7153
4/98 – 3/00	4.7226*	4.9231*	5.4674*	11.5560***

* Significant at 10%
** Significant at 5%
*** Significant at 1%

Table 4. 9 Durbin-Watson *d* Test for Autocorrelation of Residuals

Portfolio Holding Period	Durbin-Watson *d* Statistic			
	Strategy 1	Strategy 2	Strategy 3	Strategy 4
4/88 – 3/90	1.8373	1.7395	1.3907#	0.9106***
4/89 – 3/91	1.9828	2.0949	1.7069	1.4708
4/90 – 3/92	1.8651	1.9107	1.9874	2.2489
4/91 – 3/93	1.4861	1.4814	1.3349#	1.5112
4/92 – 3/94	1.5171	1.7275	1.2740#	1.4226#
4/93 – 3/95	1.9556	1.8190	1.0961***	0.7246***
4/95 – 3/97	2.1604	2.2056	2.1999	1.9575
4/96 – 3/98	2.3296	2.3296	2.3296	2.3144
4/97 – 3/99	1.6689	1.6689	1.6689	1.6689
4/98 – 3/00	2.6116#	2.5533	2.6450#	2.3974

*** Significant at 1%
# Inconclusive at 5%

4.4 *Comparison of Portfolios Using Different Strategies*

The performances of portfolios using different strategies (strategies 1, 2, 3 and 4) were compared using the portfolio return. The null hypothesis that there is no difference in the returns of portfolios using different strategies was tested with a randomized block design. Table 4.10 shows that the test statistic obtained has a value of 6.410 which leads to the rejection of the null hypothesis at the 1% level of significance. This implies that there are differences in the returns of portfolios using different strategies.

Table 4. 10 Two-way ANOVA table for comparison of portfolios performances

Source	Sum of Squares	d.f.	Mean Square	F-statistic
Treatment	4324.340	3	1441.447	6.410***
Block	69186.775	9	7687.419	34.187***
Error	6071.318	27	224.864	
Total	79582.433	39		

*** Significant at 1%

However, the use of a randomized block design requires the conditions of normality, equal error variance by treatment or block and no block-treatment interaction. The value of the test statistic for the Kolmogorov-Smirnov test is 0.614, which indicates that the normality condition is not violated.

The equality of error variance and block-treatment interaction can be checked from the residual plots in Figures 4.2 through 4.4. The plots of residuals versus treatments and residuals versus blocks show unequal error variance by block and by treatment. In addition, the plot of residuals versus fitted values reveals the existence of block and treatment interaction.

Figure 4. 2 Plot of Residuals Versus Treatments

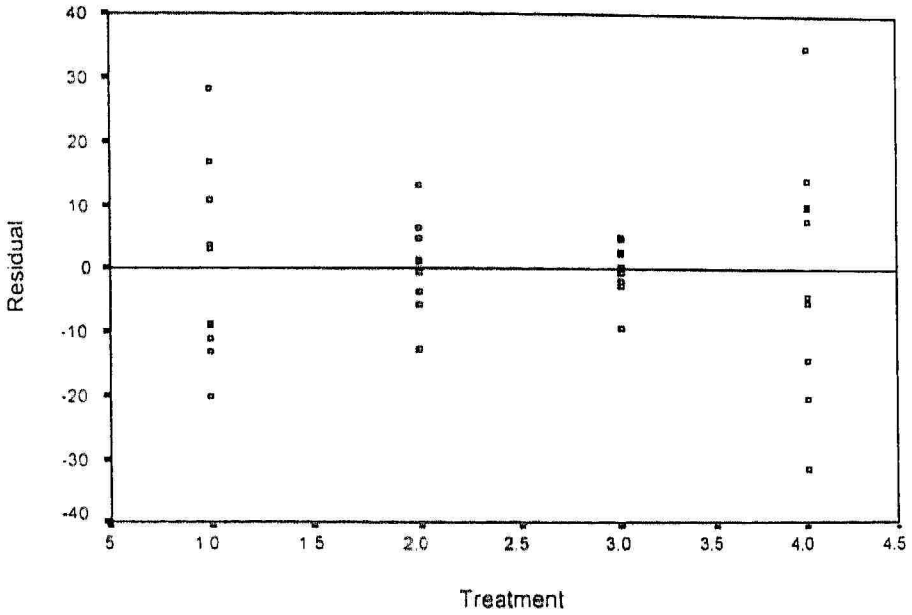


Figure 4. 3 Plot of Residuals Versus Blocks

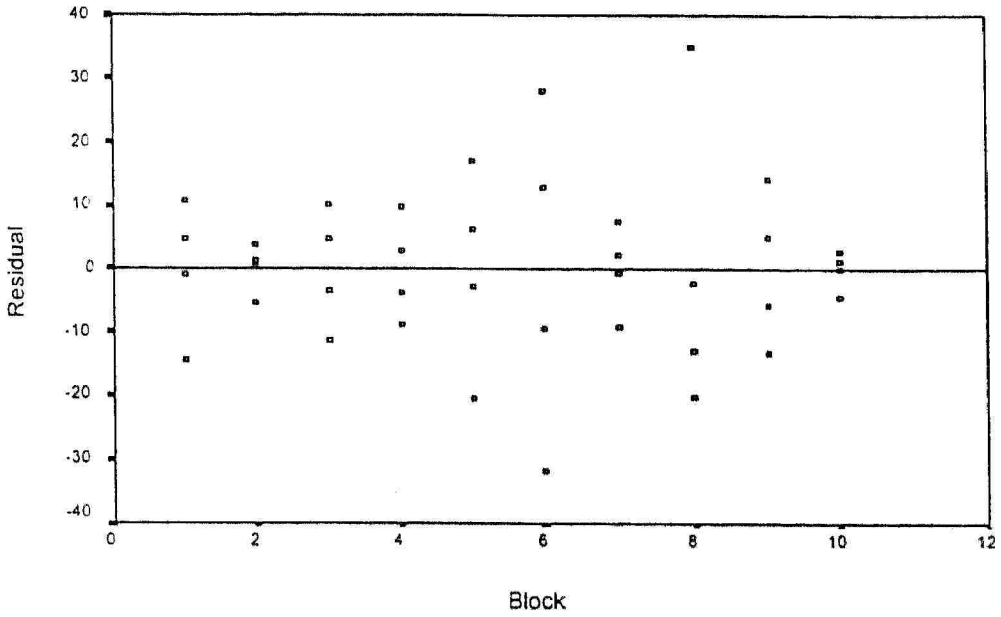
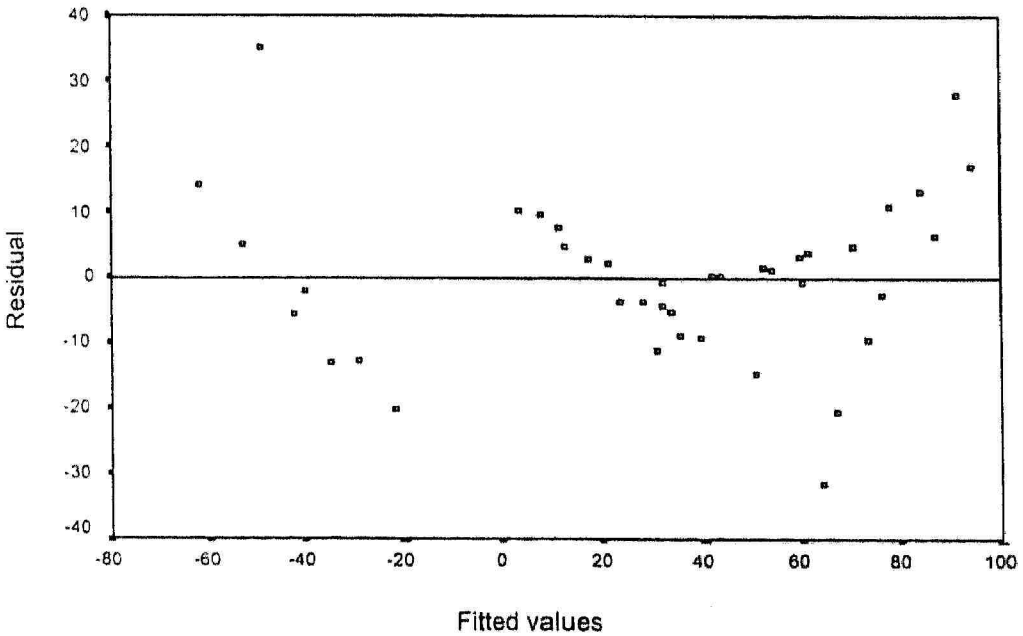


Figure 4. 4 Plot of Residuals Versus Fitted Values



Violation of the required conditions necessitates the use of a non-parametric test, in this case, the Friedman test. The result of the Friedman test is parallel to the parametric test with a value of the test statistic of 17.512; the null hypothesis is rejected at 1% level of significance. Therefore, it can be concluded that there are differences in the returns of portfolios using different strategies.

Since the results of the randomized block design and Friedman test indicate that the performances of portfolios using different strategies differ, multiple comparison tests were conducted to determine the best strategy. Both the parametric (Scheffe's test) and non-parametric versions were performed due to the violation of the required conditions. The results are presented in Table 4.11.

Scheffe's test shows positive differences between strategies 1 and 3, 1 and 4 as well as 2 and 4. On the other hand, the non-parametric test shows positive differences between strategies 1 and 3, 1 and 4, 2 and 3, and 2 and 4. Hence, it can be concluded that the better strategies are strategies 1 and 2.

Table 4. 11 Results of the Multiple Comparison Tests

Strategies	Scheffe`s Test	Non-parametric Test
	Mean Difference	Rank Difference
1 and 2	7.4130	4
1 and 3	18.1310*	14**
1 and 4	27.3560***	20**
2 and 3	10.7180	10**
2 and 4	19.9430*	16**
3 and 4	9.2250	6

* Significant at 10%
** Significant at 5%
*** Significant at 1%