CHAPTER 4

ANALYSIS AND RESULTS

4.1 Tables

The findings of this study are displayed in Tables 1 to 8 corresponding to the first eight hypotheses as set out in Chapter 2. Shown in these tables are the results for cross-sectional regressions of average returns with single risk measures (systematic risk, unsystematic risk, total risk, relative skewness, size of firm, price-to-book ratio) and multiple risk measures (systematic risk plus another risk measure). The average values of the intercepts $\hat{\delta}_0$, slope $\hat{\delta}_j$ and its corresponding t-statistics, and the average adjusted value of $\overline{R}^2$ are also shown in the tables.

4.2 The coefficient of beta and beta squared

Table 1 shows that there is no linear relationship between the average returns and systematic risks of portfolios. The regression coefficients, $\bar{\hat{\delta}}_2$, over the three test periods for the portfolio is not significant. However, for the individual stocks the relationship between average returns and systematic risk is non-linear and significant at 5% level in first and the last test periods (1983-86 and 1995-1998). The negative coefficients obtained for $\bar{\hat{\delta}}_2$ coincided with periods of downturn in the economy and stock market of the country. The explanatory powers of the two variables, beta and beta-squared taken together is very low, 4.2% and 8.4% for the two periods 1983-86 and 1995-98 respectively. These results are similar to those obtained by Ariff (1998) and Wong and Tan(1991) who found a non-linear relationship between average returns and systematic risks. Although the hypothesis of positive linear relationship between average returns and systematic risk is rejected, a significant non-linear relationship exists during the first and the last test periods.

Table 1. Cross-sectional regression for hypothesis one

		1983-86	1987-90	1991-94	1995-98
Test of Hypothesis One : $\widetilde{R}_{it} = \hat{\delta}_{ot} + \hat{\delta}_{2t}\beta_i^2 + \widetilde{U}_{it}$					
$\hat{\delta}_o$	(s)	0.0066	0.0110	0.0143	-0.0062
	(p)	-	0.0091	0.0148	-0.0012
$t(\hat{\delta}_0)$	(s)	0.8735	1.1628	1.2749	-0.0913
	(p)	-	0.0766	0.9032	0.2438
$\hat{\delta}_2$	(s)	-0.0099	0.0086	0.0042	-0.0021
	(p)	-	0.0116	0.0028	-0.0043
$t(\hat{\delta}_2)$	(s)	-1.6445	1.3205	1.0201	-0.3238
	(p)	-	1.1517	0.4098	-0.3461
$\overline{R}^2$	(s)	0.0584	0.0823	0.0491	0.0857
	(p)	-	0.2794	0.0908	0.1992
Test of Hypothesis One : $\widetilde{R}_{it} = \hat{\delta}_{ot} + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{2t}\beta_i^2 + \widetilde{U}_{it}$					
$\hat{\delta}_o$	(s)	-0.0133	-0.0069	0.0306	-0.0322
	(p)	-	-0.0073	0.0683	-0.1413
$t(\hat{\delta}_0)$	(s)	-1.1296	-0.5122	1.9424*	-1.9232*
	(p)	-	-0.2078	1.5618	-1.3076
$\hat{\delta}_1$	(s)	0.0461	0.0467	-0.0246	0.0471
	(p)	-	0.0403	-0.0943	0.2484
$t(\hat{\delta}_1)$	(s)	2.0781**	1.5082	-1.1370	1.9133*
	(p)	-	0.4759	-1.0543	1.3636
$\hat{\delta}_2$	(s)	-0.0342	-0.0180	0.0114	-0.0211
	(p)	-	-0.0116	0.0442	-0.1119
$t(\hat{\delta}_2)$	(s)	-2.7709**	-0.9739	0.8875	-2.1279**
	(p)	-	-0.2328	0.9339	-1.4749
$\overline{R}^2$	(s)	0.0422	0.0694	0.0439	0.0837
	(p)	-	0.2824	0.0674	0.1873

** statistically significant at 5%
* statistically significant at 10%
(s) average values for individual stocks
(p) average values for portfolios

4.3 Explanatory power of Unsystematic risk

As shown in Table 2, when unsystematic risk (SE) is used alone as an explanatory variable, no statistical relationship between average returns for portfolio (or individual stocks) and unsystematic risk was found. When systematic risk and unsystematic risk were used together as explanatory variables, no significant statistical relationship was found in any of the test periods for portfolios or individual stocks. This implies that the investors are not compensated for bearing unsystematic risk. The second hypothesis is rejected.

Table 2(a) Cross-sectional regression for hypothesis two

Test of hypothesis two: $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{3t} SE_i + \tilde{U}_{it}$					
		1983-86	**1987-90**	**1991-94**	**1995-98**
$\hat{\delta}_0$	**(s)**	0.0031	0.0118	0.0207	-0.0069
	(p)	-	0.0227	0.0113	-0.0058
$t(\hat{\delta}_0)$	**(s)**	0.2913	1.0293	1.7074*	-0.4612
	(p)	-	1.7476*	0.6405	-0.3692
$\hat{\delta}_3$	**(s)**	-0.0423	0.0739	-0.0270	-0.0563
	(p)	-	-0.0976	0.1854	-0.1699
$t(\hat{\delta}_3)$	**(s)**	-0.6844	1.1592	-0.4910	-0.9078
	(p)	-	-0.2205	0.5263	-0.4267
$\bar{R}^2$	**(s)**	0.0139	0.0209	0.0108	0.0100
	(p)	-	0.0957	0.0638	0.1453

Table 2(b): Cross-sectional regression for hypothesis two

Test of hypothesis two : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \delta_{3t}SE_i + \tilde{U}_{it}$					
$\hat{\delta}_o$	**(s)**	0.0120	-0.0016	0.0160	-0.0034
	(p)	-	0.0130	0.0125	0.0028
$t(\hat{\delta}_0)$	**(s)**	1.1928	-0.1680	1.5438	-0.2827
	(p)	-	0.8951	0.6706	0.1114
$\hat{\delta}_1$	**(s)**	-0.0159	0.0166	0.0065	-0.0046
	(p)	-	0.0329	0.0018	-0.0087
$t(\hat{\delta}_1)$	**(s)**	-1.4551	1.4768	0.8089	-0.2898
	(p)	-	1.7858*	0.1377	-0.4162
$\hat{\delta}_3$	**(s)**	0.0060	0.0625	-0.0391	-0.0074
	(p)	-	-0.5526	0.0871	-0.0922
$t(\hat{\delta}_3)$	**(s)**	0.1111	1.0473	-0.7643	-0.1060
	(p)	-	-1.4629	0.2439	-0.2739
$\overline{R}^2$	**(s)**	0.0394	0.0653	0.0249	0.0783
	(p)	-	0.3081	0.1016	0.2042

** statistically significant at 5%
* statistically significant at 10%
(s) average values for individual stocks
(p) average values for portfolios

4.4 Behaviour of the proxy market portfolio

Table 3 shows that the market price of risk is positive during the test periods 1987-1990 and 1991-1994 and negative during the test period 1995-1998. In all the test periods the market price of risk is not significantly different from the average return on the proxy market portfolio.

Table 3 : Behaviour of the proxy market portfolio (test of hypothesis 3)

Period	$\overline{R}_m$	$t(\overline{R}_m)$	$\overline{\delta}_1$	$t(\overline{\delta}_1)$	$t(\overline{\delta}_1 - \overline{R}_m)$
1987-1990	0.014484	0.1470	0.0203	1.1418	0.2570
1991-1994	0.013587	0.1967	0.0061	0.4673	-0.0013
1995-1998	-0.010521	-0.0949	-0.0114	-0.3941	-0.0265

** statistically significant at 5%
*statistically significant at 10%

4.5 Explanatory power of Relative Skewness

Table 4 shows that when relative skewness is used alone as an independent variable, its coefficient, $\hat{\delta}_5$, is significant at 10% level during the first test period for individual stocks (1983-86) and the last test period for portfolios (1995-98). With the inclusion of the beta variable, the coefficient of relative skewness increases from 1.8431 to 2.1456 during the test period 1995-1998 for the portfolio. Correspondingly the adjusted R^2 increases from 13.76% to 26.65%. For the test on individual stocks, the inclusion of the beta variable reduces the magnitude of the coefficient of relative skewness marginally from 2.4061 to 2.4596 whilst the adjusted R^2 increases from 2.19% to 4.53%. Based on these results, relative skewness does affect the price of individual stocks and portfolios for the test period 1983-86 and 1995-98 respectively. This implies that local investors choose individual stocks and portfolios as if the distributions of the stock's returns are skewed during the test periods 1983-86 and 1995-98 respectively. However, the explanatory powers of relative skewness and beta during the periods 1983-86 and 1995-98 are 4.5% and 26.7% respectively. This relationship is not true for the remaining test periods of individual stocks and portfolios.

Table 4. Cross-sectional regression for hypothesis four

Test of hypothesis Four : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{5t} SKEW_{it} + \tilde{U}_{it}$					
		1983-86	**1987-90**	**1991-94**	**1995-98**
$\hat{\delta}_o$	**(s)**	-0.0026	0.0184	0.0191	-0.0123
	(p)	-	0.0370	0.0201	-0.0056
$t(\hat{\delta}_0)$	**(s)**	-0.2881	1.4832	1.5396	-0.7438
	(p)	-	1.6927	1.2051	-0.2745
$\hat{\delta}_5$	**(s)**	-0.0060	-0.0015	-0.0039	-0.0046
	(p)	-	0.0370	0.0201	-0.0056
$t(\hat{\delta}_5)$	**(s)**	-2.4601**	-0.7076	-1.3864	-1.2564
	(p)	-	0.8995	1.2582	1.8431*
$\overline{R}^2$	**(s)**	0.0219	0.0166	0.0199	0.0166
	(p)	-	0.1205	0.0240	0.1376
Test of hypothesis Four : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{5t} SKEW_{it} + \tilde{U}_{it}$					
$\hat{\delta}_o$	**(s)**	0.0118	0.0034	0.0133	-0.0052
	(p)	-	-0.0006	0.0121	0.0166
$t(\hat{\delta}_0)$	**(s)**	1.3191	0.4319	1.4171	-0.4399
	(p)	-	-0.0369	0.7212	0.6935
$\hat{\delta}_1$	**(s)**	-0.0155	0.0173	0.0065	-0.0036
	(p)	-	0.0202	0.0058	-0.0187
$t(\hat{\delta}_1)$	**(s)**	0.0786	0.0785	0.0581	0.1048
	(p)	-	0.1167	0.0893	0.1749
$\hat{\delta}_5$	**(s)**	-0.0052	-0.0016	-0.0041	-0.0031
	(p)	-	0.0029	0.0036	0.0245
$t(\hat{\delta}_5)$	**(s)**	-2.4596**	-0.9361	-1.5024	-1.0430
	(p)	-	0.3827	0.3545	2.1456**
$\overline{R}^2$	**(s)**	0.0453	0.0596	0.0340	0.0678
	(p)	-	0.2814	0.0639	0.2665

** statistically significant at 5%
* statistically significant at 10%
(s) average values for individual stocks
(p) average values for portfolios

4.6 The Intercept term $\bar{\hat{\delta}}_0$

None of the average values of $\bar{\hat{\delta}}_0$ in Table 5 are significantly different from zero. This seems to suggest that there is unrestricted borrowing and lending at the unique risk free rate. Therefore the Sharp-Lintner hypothesis cannot be rejected.

Table 5. Cross-sectional regression for hypothesis five

		Test of hypothesis Five: $\tilde{R}_{it} = \hat{\delta}_{ot} + \hat{\delta}_{1t}\beta + \tilde{U}_{it}$			
		1983-86	**1987-90**	**1991-94**	**1995-98**
$\hat{\delta}_o$	**(s)**	0.0118	0.0035	0.0130	-0.0038
	(p)	-	0.0007	0.0119	0.0061
$t(\hat{\delta}_0)$	**(s)**	1.3272	0.4487	1.2706	-0.3098
	(p)	-	0.0766	0.9032	0.2438
$\hat{\delta}_1$	**(s)**	-0.0157	0.0170	0.0061	-0.0049
	(p)	-	0.0203	0.0061	-0.0114
$t(\hat{\delta}_1)$	**(s)**	-1.4117	1.4918	0.7381	-0.3165
	(p)	-	1.1418	0.4673	-0.3941
$\bar{R}^2$	**(s)**	0.0594	0.0803	0.0427	0.0810
	(p)	-	0.2731	0.0822	0.1962

** statistically significant at 5%
* statistically significant at 10%
(s) average values for individual stocks
(p) average values for portfolios

4.7 Explanatory power of Total Risk

Table 6 shows that there is no statistical relationship between average returns and total risk (σ^2) when total risk is used as an independent variable either alone or together with systematic risk. The hypothesis that investors do not hold diversified portfolio is rejected. This implies that investors in the local KLSE hold diversified portfolios.

Table 6. Cross-sectional regression for hypothesis six

		1983-86	1987-90	1991-94	1995-98
Test of hypothesis Six: $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{4t}\sigma_i^2 + \tilde{U}_{it}$					
$\hat{\delta}_o$	(s)	0.0015	0.0162	0.0165	-0.0104
	(p)	-	-0.0008	0.0129	0.0022
$t(\hat{\delta}_0)$	(s)	0.1635	1.5492	1.3370	-0.6823
	(p)	-	-0.0744	0.8859	0.1206
$\hat{\delta}_4$	(s)	-0.2077	0.1217	0.2035	-0.0824
	(p)	-	2.1181	1.2579	-1.8875
$t(\hat{\delta}_4)$	(s)	-0.6368	0.4506	0.8535	-0.4070
	(p)	-	0.8349	0.5402	-0.6445
$\bar{R}^2$	(s)	0.0159	0.0130	0.0241	0.0375
	(p)	-	0.2746	0.0973	0.2194
Test of hypothesis Six: $\tilde{R}_{it} = \hat{\delta}_{ot} + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{4t}\sigma_i^2 + \tilde{U}_{it}$					
$\hat{\delta}_o$	(s)	0.0108	0.0041	0.0124	-0.0029
	(p)	-	0.0108	0.0129	-0.0100
$t(\hat{\delta}_0)$	(s)	1.1796	0.5100	1.2484	-0.2473
	(p)	-	0.7444	0.8695	-0.4253
$\hat{\delta}_1$	(s)	-0.0163	0.0185	0.0056	-0.0068
	(p)	-	0.0880	-0.0041	0.0290
$t(\hat{\delta}_1)$	(s)	-1.4359	1.7218*	0.7000	-0.4204
	(p)	-	1.7402*	-0.1433	0.6929
$\hat{\delta}_4$	(s)	0.1607	-0.1243	0.1322	0.1027
	(p)	-	-7.4343	-0.0054	-4.3080
$t(\hat{\delta}_4)$	(s)	0.5083	-0.6530	0.6050	0.4266
	(p)	-	-1.2151	-0.0010	-0.8479
$\bar{R}^2$	(s)	0.0469	0.0632	0.0266	0.0791
	(p)	-	0.2978	0.0810	0.2114

** statistically significant at 5%
* statistically significant at 10%
(s) average values for individual stocks
(p) average values for portfolios

4.8 Explanatory power of Firm Size

Table 7 below shows that there is no statistical relationship between average returns and size of firms (as measured by logarithm of market capitalization) when size is used as an independent variable either alone or together with systematic risk with the exception of test period 1995-1998. During the test period 1995-98, average returns of individual stocks and size shows a significant positive relationship at 10% level. This contradicts the negative relationship as obtained in other studies by Lakonishok and Shapiro(1980), Banz(1981), Chan, Hamao and Lakonishok(1991) and Chou, Zhou and Hsu(1998). With the inclusion of the beta variable, the coefficient of the size variable is no longer significant. This implies that during the period 1995-98 investors who invest in stocks with larger market capitalization are likely to make more gains than those with smaller market capitalization. However the explanatory power is a low 2.8%. Overall the hypothesis that there is a negative linear relationship between average returns and size is rejected. This implies that investors in the local KLSE will not be able to profit by investing in stocks of smaller size firms.

Table 7 : Cross-sectional regression for hypothesis seven

		1983-86	1987-90	1991-94	1995-98
Test of hypothesis Seven : $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \widetilde{U}_{it}$					
$\hat{\delta}_o$	(s)	0.0033	0.0035	0.0395	-0.0366
	(p)	-	-0.0201	-0.0220	-0.0143
$t(\hat{\delta}_0)$	(s)	0.2615	0.3849	1.6023	-1.4623
	(p)	-	-1.2475	-0.5883	-0.2901
$\hat{\delta}_6$	(s)	-0.0007	0.0024	-0.0031	0.0034
	(p)		0.0064	0.0060	0.0002
$t(\hat{\delta}_6)$	(s)	-0.3764	1.2840	-1.4328	1.7088*
	(p)		1.6172	1.2612	0.0287
$\overline{R}^2$	(s)	0.0300	0.0297	0.0309	0.0276
	(p)	-	0.0990	0.0219	0.0426
Test of hypothesis Seven : $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \widetilde{U}_{it}$					
$\hat{\delta}_o$	(s)	0.0116	0.0057	0.0248	0.0024
	(p)		-0.0106	-0.0228	0.0024
$t(\hat{\delta}_0)$	(s)	1.0550	0.5456	1.3903	0.1269
	(p)	-	-0.6955	-0.6794	0.0671
$\hat{\delta}_1$	(s)	-0.0154	0.0174	0.0061	-0.0051
	(p)		0.0109	0.0000	-0.0145
$t(\hat{\delta}_1)$	(s)	-1.3756	1.5380	0.7310	-0.3262
	(p)	-	0.5251	0.0026	-0.5328
$\hat{\delta}_6$	(s)	0.0000	-0.0004	-0.0017	-0.0007
	(p)	-	0.0033	0.0058	0.0010
$t(\hat{\delta}_6)$	(s)	-0.0219	-0.3009	-1.0998	-0.3450
	(p)	-	0.8937	1.1195	0.2117
$\overline{R}^2$	(s)	0.0438	0.0699	0.0226	0.0702
	(p)	-	0.2598	0.1061	0.2299

** statistically significant at 5%
* statistically significant at 10%
(s) average values for individual stocks
(p) average values for portfolios

4.9 Results using limited availability of price-to-book value ratio

Further findings of this study based on limited availability of PBV data and three different portfolio formation procedures are displayed in Tables 8 to 11 for testing hypotheses 7 and 8 as set out in Chapter 2. These tables show the results for cross-sectional regressions of average returns with single risk measures (systematic risk, size of firm, price-to-book ratio) and multiple risk measures (systematic risks plus another risk measure). The average values of the intercepts $\hat{\delta}_o$, slope $\hat{\delta}_j$ and its corresponding t-statistics, and the adjusted value of R^2 are also shown in the tables. The Tables 8(a) - (c) show summary statistics for portfolios formed by various grouping procedures for the period 31st July 1989 - 30th June 1998.

Table 8(a) : Summary of Portfolio (sorted by beta) Statistics

Portfolio	Average Betas	Average Size	Average PBV	Average Returns
PORTFOLIO 1	1.0117	6.2029	3.0555	-0.0020
PORTFOLIO 2	1.0916	6.7512	3.9603	0.0076
PORTFOLIO 3	1.0602	6.9537	2.8695	0.0056
PORTFOLIO 4	1.1208	6.8230	3.0819	0.0007
PORTFOLIO 5	1.0295	7.0116	3.1959	0.0031
PORTFOLIO 6	1.1938	7.1779	2.5405	0.0025
PORTFOLIO 7	1.0702	6.8658	2.4236	-0.0002
PORTFOLIO 8	1.1471	6.5513	2.1908	0.0025
PORTFOLIO 9	1.3138	6.6163	2.7446	0.0023
PORTFOLIO 10	1.1459	6.8410	2.6635	0.0018
Mean	1.1185	6.7795	2.8726	0.0024
Std Dev.	0.0889	0.2724	0.4946	0.0027
Correlation*	0.0742	0.4185	0.4860	-

Table 8(b) : Summary of Portfolio(sorted by size) Statistics

Portfolio	Average betas	Average Size	Average PBV	Average Returns
PORTFOLIO 1	1.5370	4.7977	2.2752	-0.0006
PORTFOLIO 2	1.4417	5.5756	1.9175	0.0055
PORTFOLIO 3	1.2000	5.8562	2.3261	0.0038
PORTFOLIO 4	1.0680	6.1981	2.4206	0.0047
PORTFOLIO 5	1.1581	6.4885	2.5134	-0.0007
PORTFOLIO 6	1.1108	6.8724	3.5263	0.0014
PORTFOLIO 7	0.8965	7.2429	3.0538	0.0044
PORTFOLIO 8	1.1232	7.5308	2.7549	-0.0028
PORTFOLIO 9	0.8254	7.9699	4.3317	0.0045
PORTFOLIO 10	1.0777	8.9412	3.6067	-0.0001
Mean	1.1438	6.7473	2.8726	0.0020
Std Dev.	0.2162	1.2256	0.7486	0.0029
Correlation*	-0.2168	-0.1769	-0.0164	-

Table 8(c) : Summary of Portfolio(sorted by size then beta) Statistics

Portfolio	Average Betas	Average Size	Average PBV	Average Returns
PORTFOLIO 1	1.1152	5.8746	2.1376	-0.0771
PORTFOLIO 2	1.4049	5.6771	2.1155	1.5999
PORTFOLIO 3	0.9317	5.6790	2.2848	2.1918
PORTFOLIO 4	1.3145	5.7821	2.2755	3.0476
PORTFOLIO 5	1.0649	5.8820	2.7395	5.9296
PORTFOLIO 6	0.7549	7.5165	3.3843	-1.5093
PORTFOLIO 7	1.1925	7.8310	3.4633	2.0247
PORTFOLIO 8	0.7574	7.7549	3.3775	2.6168
PORTFOLIO 9	1.0630	7.7104	2.8662	3.7930
PORTFOLIO 10	0.8616	7.7269	4.2061	0.4216
Mean	1.0461	6.7435	2.8850	0.0020
Std Dev.	0.2218	1.0218	0.7052	0.0021
Correlation*	0.2906	-0.2205	-0.2271	-

*Correlation with average returns

4.10 Explanatory power of firm size and PBV for different portfolio formation

Tables 9(a) and 9(b) below reveal no significant relationship between average returns and beta or size. However a significant relationship at 5% level.

Table 9(a). Cross-sectional regression for hypothesis eight: portfolios (sorted by size then beta)

Test of hypothesis : $\tilde{R}_{it} = \hat{\delta}_{ot} + \hat{\delta}_{1t}\beta_i + \tilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0328	0.0001	0.0165
$t(\hat{\delta}_0)$	1.9478	0.0097	1.5169
$\hat{\delta}_1$	-0.0059	-0.0220	-0.0140
$t(\hat{\delta}_1)$	-0.4118	-1.1886	-1.1969
$\overline{R}^2$	0.0345	0.1124	0.0734
Test of hypothesis seven : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \tilde{U}_{it}$			
$\hat{\delta}_o$	0.0566	-0.0542	0.0012
$t(\hat{\delta}_0)$	1.2059	-1.3926	0.0396
$\hat{\delta}_6$	-0.0051	0.0039	-0.0006
$t(\hat{\delta}_6)$	-1.1101	1.1058	-0.2098
$\overline{R}^2$	0.1199	0.1290	0.1245
Test of hypothesis seven : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \tilde{U}_{it}$			
$\hat{\delta}_o$	0.0970	-0.0414	0.0278
$t(\hat{\delta}_0)$	1.8074	-1.0860	0.8250
$\hat{\delta}_1$	-0.0198	-0.0080	-0.0139
$t(\hat{\delta}_1)$	-1.6552	-0.4597	-1.3209
$\hat{\delta}_6$	-0.0077	0.0033	-0.0022
$t(\hat{\delta}_6)$	-1.6145	0.9480	-0.7317
$\overline{R}^2$	0.1001	0.1381	0.1191

** statistically significant at 5%
* statistically significant at 10%

Table 9(b). Cross-sectional regression for hypothesis eight: portfolios (sorted by size then beta)

	1992-1995	1995-1998	1992-98
Test of hypothesis eight : $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{7t} PBV_{i,t-1} + \widetilde{U}_{it}$			
$\hat{\delta}_o$	0.0435	-0.0264	0.0085
$t(\hat{\delta}_0)$	1.8896	-1.3437	0.5473
$\hat{\delta}_7$	-0.0073	0.0000	-0.0037
$t(\hat{\delta}_7)$	-2.1056**	-0.0042	-1.6519*
$\overline{R}^2$	0.0271	0.0023	0.0147
Test of hypothesis eight : $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{7t} PBV_{i,t-1} + \widetilde{U}_{it}$			
$\hat{\delta}_o$	0.0796	0.0033	0.0415
$t(\hat{\delta}_0)$	2.5012**	0.2010	2.2639**
$\hat{\delta}_1$	-0.0257	-0.0237	-0.0247
$t(\hat{\delta}_1)$	-1.5509	-1.2419	-1.9685*
$\hat{\delta}_7$	-0.0100	-0.0015	-0.0057
$t(\hat{\delta}_7)$	-2.1411**	-0.5449	-2.1038**
$\overline{R}^2$	0.0710	0.1119	0.0914

' statistically significant at 5%
statistically significant at 10%

exists between average returns and PBV during the test period 1992-1995 ınd the combined test period 1992-1998 when the portfolios are formed by ranking 'y size and then by beta. The explanatory powers of this variable PBV during the orresponding periods are 2.7% and 1.4% respectively. Further the coefficients for 'BV is negative which is consistent with other studies by Chan, Hamao and akonishok(1991) and Fama and French(1992). These studies show that the book-)-market equity explains the cross-sectional variation in expected returns and that ıe coefficient is positive. Since PBV is the reciprocal of book-to-market equity the ɔefficient of PBV is expected to be negative.

'ith the inclusion of two variables (i.e. Beta plus Size or Beta plus PBV) in the 'oss-sectional time series regression the coefficient of the Size variable is significant while the PBV coefficient is significant at 5% level during the test period 992-1995 and the combined test period 1992-1998. The explanatory powers of the ariable PBV drop to 7% and 9% during the respective test periods. The coefficient f PBV remains negative and its magnitude has increased from 2.1056 to 2.1411 nd 1.6579 to 2.1038 during the respective test periods.

Table 10(a) shows a significant positive relationship between average returns f portfolios (sorted by beta) and size during the combined test period 1992-1998 at 0% level. The positive coefficient of the size variable contradicts those obtained in ther studies by Banz(1981), Chan, Hamao and Lakonishok(1991) Fama and rench(1992). Also size explains only 5.4% of the variation in average returns. With ıe inclusion of the beta variable only the size variable continues to be positive and ignificant at 10% only during the test period 1995-1998 with an adjusted 16.9%. 'he positive coefficient of the size variable implies that the investor will earn better ıverage returns by investing in shares of relatively larger size firms.

There is no relationship between average returns of portfolio and the PBV 'ariable as can be seen from Table 10(b). When the beta variable is included with he variable PBV as independent variables, the coefficient for PBV is insignificant in ıll the test periods. The sign of this coefficient is negative and consistent with studies ›y Fama and French(1992) and Chou and Zhou(1998).

'**able 10(a)**. Cross-sectional regression for hypothesis seven: portfolios (sorted by beta)

Test of hypothesis : $\tilde{R}_{it} = \hat{\delta}_{ot} + \hat{\delta}_{1t}\beta_i + \tilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0479	-0.0399	0.0040
$t(\hat{\delta}_0)$	1.3436	-1.6107	0.1803
$\hat{\delta}_1$	-0.0145	0.0108	-0.0018
$t(\hat{\delta}_1)$	-0.6049	0.4463	-0.1083
$\overline{R}^2$	0.0506	0.0287	0.0397
Test of hypothesis seven : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \tilde{U}_{it}$			
$\hat{\delta}_o$	-0.0291	-0.0722	-0.0507
$t(\hat{\delta}_0)$	-0.5265	-1.6801*	-1.4529
$\hat{\delta}_6$	0.0070	0.0067	0.0068
$t(\hat{\delta}_6)$	1.0508	1.6245	1.7583*
$\overline{R}^2$	0.0421	0.0665	0.0543
Test of hypothesis seven : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \tilde{U}_{it}$			
$\hat{\delta}_o$	0.0142	-0.1331	-0.0595
$t(\hat{\delta}_0)$	0.2445	-2.2206**	-1.4050
$\hat{\delta}_1$	-0.0036	0.0361	0.0163
$t(\hat{\delta}_1)$	-0.1598	1.2839	0.9041
$\hat{\delta}_6$	0.0029	0.0095	0.0062
$t(\hat{\delta}_6)$	0.4723	2.0591**	1.6167
$\overline{R}^2$	0.0925	0.1686	0.1305

** statistically significant at 5%
* statistically significant at 10%

'able 10(b). Cross-sectional regression for hypothesis eight: portfolios (sorted by eta)

Test of hypothesis eight: $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{7t} PBV_{i,t-1} + \tilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0254	-0.0322	-0.0034
$t(\hat{\delta}_0)$	1.0892	-1.5578	-0.2138
$\hat{\delta}_7$	-0.0020	0.0037	0.0008
$t(\hat{\delta}_7)$	-0.6282	1.3487	0.3905
$\bar{R}^2$	0.0452	0.0707	0.0579

Test of hypothesis eight: $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{7t} PBV_{i,t-1} + \tilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0500	-0.0444	0.0028
$t(\hat{\delta}_0)$	1.3596	-1.8129*	0.1230
$\hat{\delta}_1$	-0.0185	0.0098	-0.0044
$t(\hat{\delta}_1)$	-0.7599	0.4493	-0.2692
$\hat{\delta}_7$	0.0006	0.0035	0.0020
$t(\hat{\delta}_7)$	0.2362	1.5497	1.2036
$\bar{R}^2$	0.0791	0.0655	0.0723

* statistically significant at 5%
* statistically significant at 10%

Table 11(a) shows that there is no relationship between average returns of portfolios and size with or without the inclusion of the beta variable. No relationship exists between average returns and PBV in any of the test periods as shown in Table 11(b) except for the test period 1992-1995. The negative coefficient obtained is consistent with other studies by Chan, Hamao and Lakonishok(1991) Fama and French(1992). The adjusted R^2 is only 0.6% and the coefficient is significant at 5% level.

able 11(a). Cross-sectional regression for hypothesis seven: portfolios (sorted by ize)

Test of hypothesis : $\tilde{R}_{it} = \hat{\delta}_{ot} + \hat{\delta}_{1t}\beta_i + \tilde{U}_{it}$

	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0172	0.0154	0.0163
$t(\hat{\delta}_0)$	0.6240	1.0207	1.0447
$\hat{\delta}_7$	0.0081	-0.0357	-0.0138
$t(\hat{\delta}_7)$	0.2591	-1.5805	-0.7115
$\overline{R}^2$	0.1194	0.1950	0.1572

Test of hypothesis seven: $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{6t} \ln(mkt)_{i,t-1} + \tilde{U}_{it}$

	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0528	-0.0532	-0.0002
$t(\hat{\delta}_0)$	1.1469	-1.3683	-0.0073
$\hat{\delta}_6$	-0.0045	0.0038	-0.0003
$t(\hat{\delta}_6)$	-1.0001	1.1402	-0.1171
$\overline{R}^2$	0.1448	0.1151	0.1300

Test of hypothesis seven : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{6t} \ln(mkt)_{i,t-1} + \tilde{U}_{it}$

	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0318	0.0172	0.0245
$t(\hat{\delta}_0)$	0.7446	0.6846	0.9953
$\hat{\delta}_1$	0.0103	-0.0338	-0.0118
$t(\hat{\delta}_1)$	0.3943	-1.5356	-0.6842
$\hat{\delta}_6$	-0.0026	-0.0003	-0.0014
$t(\hat{\delta}_6)$	-0.6786	-0.1625	-0.6770
$\overline{R}^2$	0.1768	0.1703	0.1735

Table 11(b). Cross-sectional regression for hypothesis eight: portfolios (sorted by size)

	1992-1995	1995-1998	1992-98
Test of hypothesis eight: $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{7t} PBV_{i,t-1} + \widetilde{U}_{it}$			
$\hat{\delta}_o$	0.0419	-0.0340	0.0040
$t(\hat{\delta}_0)$	1.6195	-1.4457	0.2203
$\hat{\delta}_7$	-0.0073	0.0053	-0.0010
$t(\hat{\delta}_7)$	-2.1372**	1.4438	-0.3773
$\overline{R}^2$	0.0057	0.0210	0.0134
Test of hypothesis eight : $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{7t} PBV_{i,t-1} + \widetilde{U}_{it}$			
$\hat{\delta}_o$	0.0290	-0.0062	0.0114
$t(\hat{\delta}_0)$	0.9428	-0.2675	0.5954
$\hat{\delta}_1$	0.0033	-0.0222	-0.0095
$t(\hat{\delta}_1)$	0.1100	-1.0017	-0.5050
$\hat{\delta}_7$	-0.0029	0.0040	0.0005
$t(\hat{\delta}_7)$	-1.0637	1.3210	0.2669
$\overline{R}^2$	0.1248	0.1778	0.1513

** statistically significant at 5%
* statistically significant at 10%

However when the beta variable is included no significant relationship exists between average returns and PBV. These results imply that investments in high PBV firms (i.e. low book-to-market equity) earn higher average returns than investments in low PBV firms during the rest period 1992-1995.

4.11 Explanatory power of firm size and PBV for different portfolio formations I

Tables 12(a) - (c) show that cross-sectional regression of portfolio returns on the two independent variables, PBV and Size, results in no significant coefficients irrespective of portfolio grouping procedures.

Table 12(a) : Cross-sectional regression : portfolios (sorted by size) -two independent variables

Test of hypothesis : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{6t} \ln(mkt)_{i,t-1} + \hat{\delta}_{7t} PBV_{i,t-1} + \tilde{U}_{it}$

	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0529	-0.0467	0.0031
$t(\hat{\delta}_0)$	1.1349	-1.3235	0.1041
$\hat{\delta}_6$	-0.0050	0.0017	-0.0017
$t(\hat{\delta}_6)$	-0.9460	0.5285	-0.5312
$\hat{\delta}_7$	0.0018	0.0055	0.0037
$t(\hat{\delta}_7)$	0.4741	1.6809	1.4681
$\bar{R}^2$	0.1031	0.1155	0.1093

Table 12(b) : Cross-sectional regression : portfolios (sorted by beta) -two independent variables

Test of hypothesis : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{6t} \ln(mkt)_{i,t-1} + \hat{\delta}_{7t} PBV_{i,t-1} + \tilde{U}_{it}$

	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	-0.0275	-0.0762	-0.0519
$t(\hat{\delta}_0)$	-0.5200	-1.8756	-1.5607
$\hat{\delta}_6$	0.0065	0.0069	0.0067
$t(\hat{\delta}_6)$	1.0230	1.7477	1.8037
$\hat{\delta}_7$	0.0007	0.0023	0.0015
$t(\hat{\delta}_7)$	0.2127	0.9429	0.7466
$\bar{R}^2$	0.0268	0.1363	0.0816

Table 12(c) : Cross-sectional regression : portfolios (sorted by size then beta) -two independent variables

Test of hypothesis : $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \hat{\delta}_{7t}PBV_{i,t-1} + \tilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_0$	0.0601	-0.0589	0.0006
$t(\hat{\delta}_0)$	1.2799	-1.4782	0.0184
$\hat{\delta}_6$	-0.0049	0.0051	0.0001
$t(\hat{\delta}_6)$	-0.9497	1.3310	0.0446
$\hat{\delta}_7$	-0.0011	-0.0024	-0.0017
$t(\hat{\delta}_7)$	-0.3008	-0.8097	-0.7518
$\bar{R}^2$	0.1366	0.1144	0.1255

4.12 Explanatory power of betas, firm size and PBV for different portfolios formation II

Tables 13(a) - (c) also show that cross-sectional regression of portfolio returns on the three independent variables, beta, PBV and Size, results in no significant coefficients .

Table 13(a) : Cross-sectional regression : portfolios (sorted by size) -three independent variables

Test of hypothesis: $\tilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{7t}PBV_{i,t-1} + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \tilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_0$	0.0325	0.0079	0.0202
$t(\hat{\delta}_0)$	0.7554	0.2875	0.7963
$\hat{\delta}_1$	0.0153	-0.0253	-0.0050
$t(\hat{\delta}_1)$	0.5508	-1.1596	-0.2840
$\hat{\delta}_7$	0.0009	0.0040	0.0024
$t(\hat{\delta}_7)$	0.2398	1.2474	0.9888
$\hat{\delta}_6$	-0.0033	0.0058	0.0012
$t(\hat{\delta}_6)$	-0.7255	1.6374	0.4214
$\bar{R}^2$	0.2755	0.2721	0.2738

able 13(b) : Cross-sectional regression : portfolios (sorted by beta) -three independent variables

Test of hypothesis: $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{7t}PBV_{i,t-1} + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \widetilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0283	-0.1313	-0.0515
$t(\hat{\delta}_0)$	0.4801	-1.5561	-0.9919
$\hat{\delta}_1$	-0.0115	0.0376	0.0131
$t(\hat{\delta}_1)$	-0.4659	0.9757	0.5712
$\hat{\delta}_7$	0.0025	0.0016	0.0021
$t(\hat{\delta}_7)$	0.9510	0.6490	1.1469
$\hat{\delta}_6$	0.0011	0.0058	0.0035
$t(\hat{\delta}_6)$	0.1834	1.6374	0.9759
$\overline{R}^2$	0.2059	0.3249	0.2654

'able 13(c) : Cross-sectional regression : portfolios (sorted by size then beta) -three independent

'ariables

Test of hypothesis: $\widetilde{R}_{it} = \hat{\delta}_0 + \hat{\delta}_{1t}\beta_i + \hat{\delta}_{7t}PBV_{i,t-1} + \hat{\delta}_{6t}\ln(mkt)_{i,t-1} + \widetilde{U}_{it}$			
	1992-1995	**1995-1998**	**1992-98**
$\hat{\delta}_o$	0.0574	-0.0667	-0.0046
$t(\hat{\delta}_0)$	1.1395	-1.7862	-0.1449
$\hat{\delta}_1$	0.0038	0.0013	0.0026
$t(\hat{\delta}_1)$	0.2714	0.0710	0.2253
$\hat{\delta}_7$	0.0038	0.0013	0.0026
$t(\hat{\delta}_7)$	0.7635	0.4602	0.8922
$\hat{\delta}_6$	-0.0063	0.0058	-0.0002
$t(\hat{\delta}_6)$	-1.1369	1.6374	-0.0695
$\overline{R}^2$	0.2829	0.2433	0.2631

irrespective of portfolio grouping procedures.