Chapter-5

Impact of Stock Market Volatility and Firm's Size on Return

The Indian stock market has witnessed metamorphic changes and transition from a dull to an emerging stock market in international arena over the decade of 1990s. Improved market surveillance, trading mechanism and introduction of new financial instruments have made it centre of attraction for even international investors. Entry of Foreign Institutional Investors (FIIs) and at the domestic level, speculator growth of corporate sector and mutual fund has further added to the depth and width of the Indian stock market. Introduction of screen based trading, depository system; derivative instruments rolling settlements etc. have changed the very complexion of the stock market. In such an emerging market, security analysts, institutional investors, fund managers and other market players continuously search for trading strategies that can outperform the market. In this context few empirical studies have shown the availability of extra normal returns by using a number of variables such as size (Banz, 1981), leverage (Bhandari, 1988), price earnings ratio (Basu, 1977), book to market ratio (Stattman, 1980). These evidences since inconsistent with the capital asset pricing model (CAPM), are popularly known as CAPM anomalies. Of these, size effects are by far the most strongly documented and widely researched upon CAPM anomaly in the matured market.

The study here investigates the relationship between expected return and firm size. Firm size is classified into three categories, viz; small size firm, medium size firm and large size firm based on a composite index constructed by using market capitalization, net sales and profit after tax. The chapter also shows the relationship

between firm size and expected return from investment. The chapter also explains the effect of change in volatility on expected return for each category of firm size. The chapter is divided into two sections viz; section 5.1 and 5.2. Section, 5.1 deals with sector wise analysis of expected return and firm size and section 5.2 show comparative analysis among six sectors viz. automobile sector, banking sector, energy sector, financial sector, FMCG sector and IT sector.

5.1 Sector wise Analysis of Expected return and Firm Size

In order to examine the relationship between expected return and firm size the panel regression is used in this section. The specification of the panel regression is given below $r_{it} = \alpha_1 + \theta_1 D_1 + \theta_2 D_2 + \theta_3 D_3 + \beta_1 h_{it} + \delta_1 P_2 + \delta_2 P_3 + \varepsilon_{it} \quad \ldots\ldots\ldots(5)$

Where; i stands for i th cross sectional unit, i = 1,2, ...,N

t stands for t th time period t = 1,2, ...,T

r_{it} is the predicted return of i^{th} firms at t^{th} periods.

h_{it} is the conditional variance of i^{th} firms at t^{th} periods.

D_1 = 1 for small size firm or 0 otherwise

D_2 = 1 for medium size firm or 0 otherwise

D_3 = 1 for large size firm or 0 otherwise

$P_1 = h_t$ for medium size firms or 0 otherwise

$P_2 = h_t$ for large size firms or 0 otherwise

D_1, D_2 & D_3 are intercept dummies and P_1 & P_2 are slope dummies.

This is already mentioned in the methodology section of Chapter 3.

This section consists with two sub-sections viz; 5.1.1 and 5.1.2. The first sub-section 5.1.1 shows the identification of appropriate model and second sub-section 5.1.2 shows sector wise analysis of the relationship between expected return and firm size.

5.1.1 Identification of Appropriate Model:

There are two types of panel regression model viz; Fixed effect model and Random effect model. Fixed effect model is of two types viz; Pooling ordinary least square model (Least square without dummy variable) and Least square dummy variable model. The appropriate model would be selected on the basis of following tests viz; Hausman Test, LM Test or F-Test. The Hausman Test shows whether the model will be Fixed effect model or Random effect. If it shows the test is significant then it implies Fixed effect model otherwise it will be Random effect model. For significance of Hausman Test need another test (F-Test) to decide the model will be Least square without dummy variable or Least square dummy variable.

Hausman Test:

The Hausman Test examines if the individual effects are uncorrelated with other regressors in the model. If individual effects are correlated with any other regressors the random effect model violates a Guass Markov assumption and is no longer best linear unbiased estimates (BLUE). Because individual effects are parts of error term in a random effect model. Therefore, if the null hypothesis is rejected, a fixed effect model is favoured over the random counterpart.

Table 5.1.1: Result of Hausman Test for Different Sectors

Hausman Test (REM Vs FEM)			
Sectors	Chi-Square	P-Value	Conclusion
Automobile Sector	-1.52		Inconclusive (REM)
Banking Sector	0.10	0.99	REM
Energy Sector	3.28	0.35	REM
Financial Sector	1.95	0.58	REM
FMCG Sector	-222.92		Inconclusive (REM)
IT Sector	0.11	0.99	REM

Source: Estimated based on secondary data collected from www.nseindia.com, 2014

Because in a fixed effect model individual effects are parts of intercept. If the difference of covariance matrices is not positive definite then it can be concluded that the null hypothesis is not rejected assuming similarity of the covariance matrices (Green, 2008).

The result of Hausman test suggest that random effect model is better than that of fixed effect model for banking sector, energy sector, financial sector and IT sector. However, for automobile and FMCG sector the chi-square value is negative that means the result is inconclusive. In such a situation we can use random effect model as mentioned by Green (2008).

5.1.2 Sector wise Analysis of Expected Return and Firm Size:

In this subsection we analyses the sector wise relationship between the expected return and firm size. There are six sectors viz; automobile sector, banking sector, energy sector, financial sector, FMCG sector and IT sector.

Analysis of Expected Return and Firm Size in Automobile Sector

Table 5.1.2: Random-Effects GLS Regression for Automobile Sector

Group variable: PI		Number of observation = 17650		
		Number of groups = 11		
R-Square:	Within = 0.0108	Observation per group: min = 661		
	Between= 0.1361	Average = 1604.5		
	Overall = 0.0139	Maximum = 2241		
Corr.(u_i, X) = 0 (assumed)		Wald $chi^2(5)$ = 194.23		
Dependent Variable = Return		Prob. > chi^2 = 0.0000		
Coefficients	Value of Coefficients	Std. Error	t-statistic	P-Value
β_1	0.00049	0.000324	1.53	0.127
θ_1	-0.00047	0.000278	-1.7	0.090
θ_2	-0.00011	0.000298	-0.38	0.707
δ_1	-0.08133	0.024438	-3.33	0.001
δ_2	-0.00287	0.00037	-7.76	0.000
α_1	0.000313	0.000195	1.6	0.100
Sigma u		0.000379		
Sigma e		0.003322		
Rho		0.012869		

Source: Estimated based on secondary data collected from www.nseindia.com, 2014

From Table 5.1.2, it is observed that the intercept term (α_1) which captures the structural factors for large size firms is significant at ten per cent level of significant and that implies there would be a positive expected return (0.031percent) from investment in large size firms without any risk though the magnitude is very small in this case. The intercept differential term (θ_1) of small size firm as compared to large size firm is negative and statistically significant at less than ten per cent level of significance. This indicates that the intercept differential impact of small size firm as compared to large size firm on expected return decreases by 0.047 per cent in case of automobile sector. The expected return decreases by 0.016 per cent in case of small size firm. However, the effect of medium size firm (θ_2) on expected return is not statistically significant.

There is no statistically significant effect of change in volatility of small size firms on expected return for automobile sector. The estimated coefficient (β_1) is positive but statistically insignificant. The slope differential effect of medium size firm as compared to small size firm (δ_1) is negative and statistically significant at one per cent level of significance. This indicates that if volatility increases by one per cent for medium size firms then expected return may decreases by approximately 8 per cent compare to small size firms. The slope differential effect of large size firms compare to small size firms (δ_2) is also negative and statistically significant at one per cent level of significance. For large size firm, one per cent increase in volatility may result 0.2 per cent decrease in expected return of large size firms compare to small size firms. The slope differential effect of large size firms is relatively lower than that of medium size firms.

Analysis of Expected Return and Firm Size in Banking Sector

From Table 5.1.3, it is observed that the intercept term (α_1), which captures the structural factors for large size firms of banking sector, is significant at less than five per cent level of significance. This implies that there would be a positive expected return (0.046 per cent) from investment in large size firms without any risk. The intercept differential impact of small size firm (θ_1) and medium size firm (θ_2) as compared to large size firm is negative but statistically insignificant. This indicates that small size firm and medium size firm has no statistically significant effect on expected return.

Table 5.1.3: Random-Effects GLS Regression for Banking Sector (REM)

Group variable: PI		Number of observation = 23465		
		Number of groups = 11		
R-Square:	Within = 0.0010	Observation per group: min = 1645		
	Between = 0.1015	Average = 2133.2		
	Overall = 0.0017	Maximum = 2239		
Corr.(u_i, X) = 0 (assumed)		Wald $chi^2(5)$ = 23.63		
Dependent Variable = Return		Prob. > chi^2 = 0.0000		
Coefficients	Value of Coefficients	Std. Error	t-statistic	P-Value
β_1	0.092856	0.043293	2.14	0.032
θ_1	-0.000049	0.00028	-0.17	0.862
θ_2	-0.000129	0.00028	-0.46	0.645
δ_1	-0.1010317	0.043339	-2.33	0.020
δ_2	-0.0243486	0.0688117	0.35	0.723
α_1	0.0004654	0.0002135	2.18	0.029
Sigma u		.0003571		
Sigma e		.00289136		
Rho		.01502421 (fraction of variance due to u_i)		

Source: Estimated based on secondary data collected from www.nseindia.com, 2014

There is statistically significant effect of change in volatility of small size firms on expected return for banking sector as the estimated coefficient of volatility (β_1) is positive and statistically significant at less than five per cent level of significance. The slope differential effect of medium size firm as compared to small size firm (δ_1) is negative and statistically significant at less than five per cent level of significance. This indicates that if volatility increases by one per cent for medium size firms then expected return may decreases by approximately ten per cent as compared to small size firms. The slope differential effect of large size firms compare to small size firms (δ_2) is negative but statistically insignificant.

Table 5.1.4: Random-Effects GLS Regression for Energy Sector

Group variable: PI		Number of observation = 22492		
		Number of groups = 14		
	Within = 0.0073	Observation per group: min = 970		
R-Square:	Between = 0.0013	Average = 1606.6		
	Overall = 0.0037	Maximum = 2241		
Corr.(u_i, X) = 0 (assumed)		Wald $chi^2(5)$ = 164.12		
Dependent Variable = Return		Prob. > chi^2 = 0.0000		
Variable	Coefficients	Std. Error	t-statistic	P-Value
β_1	0.8042836	0.0640687	12.55	0.000
θ_1	-0.0009127	0.000449	-2.03	0.042
θ_2	-0.0000373	0.000421	-0.09	0.930
δ_1	-0.7100364	0.0754138	-9.42	0.000
δ_2	-0.7732675	0.0764437	- 10.12	0.000
α_1	-0.0003858	0.0002989	-1.29	0.197
Sigma u		0.00065		
Sigma e		0.00386		
Rho		0.0278 (fraction of variance due to u_i)		

Source: Estimated based on secondary data collected from www.nseindia.com, 2014

From Table 5.1.4, it is observed that the intercept term (α_1), which captures the structural factors for large size firms of energy sector, is negative but statistically insignificant. The intercept differential term (θ_1) of small size firm as compared to large size firm is negative and statistically significant at less than five per cent level of significance. This indicates that the intercept differential impact of small size firm as compared to large size firm on expected return decreases by 0.091 per cent in case of energy sector. The expected return decreases by 0.129 per cent in case of small size firm. However, the effect of medium size firm (θ_2) on expected return is not statistically significant.

From Table 5.1.4, it is observed that the estimated coefficient of volatility (β_1) is positive and statistically significant at less than one percent level of significance. This

indicates that there is positive relationship between expected return and volatility of small size firms for energy sector. This means that if volatility of small size firms increases by one per cent then expected return also increases by 80 per cent. The slope differential effect of medium size firm as compared to small size firm (δ_1) is negative and statistically significant at less than one per cent level of significance. This indicates that if volatility increases by one percent for medium size firms then expected return may decreases by approximately 71 per cent. The slope differential effect of large size firm as compared to small size firm (δ_1) is also negative and statistically significant at less than 1 percent level of significance. This indicates that if volatility increases by one percent for large size firms then expected return may decreases by approximately 77 per cent.

Analysis of Expected Return and Firm Size in Financial Sector

From Table 5.1.5, it is observed that the intercept term (α_1), which captures the structural factors for large size firms of financial sector, is positive and statistically significant at less than 1 per cent level of significance. This implies that there would be a positive expected return (0.087 per cent) from investment in large size firms without any risk. The intercept differential impact of small size (θ_1) firm and medium size (θ_1) firm as compared to large size firm is negative but statistically insignificant. This indicates that small size firm and medium size firm as compared to large size firm has no statistically significant effect on expected return.

From Table 5.1.5, it is observed that the estimated coefficient of volatility (β_1) is negative and statistically significant at less than one percent level of significance. This indicates that there is negative relationship between expected return and volatility of

small size firms for financial sector. This means that if volatility of small size firms increases by one percent then expected return decreases by 1.5 percent.

Table 5.1.5: Random-Effects GLS Regression for Financial Sector

Group variable: PI		Number of observation = 24020		
		Number of groups = 14		
	Within = 0.0218	Observation per group: min = 662		
R-Square:	Between = 0.1084	Average = 1715.7		
	Overall = 0.0250	Maximum = 2240		
Corr.(u_i, X) = 0 (assumed)		Wald $chi^2(5)$ = 536.88		
Dependent Variable = Return		Prob. > chi^2 = 0.0000		
Variable	Coefficients	Std. Error	t-statistic	P-Value
β_1	-0.0155838	0.0015421	-10.11	0.000
θ_1	-0.0002919	0.0003268	-0.89	0.372
θ_2	-0.0003799	0.0003099	-1.23	0.220
δ_1	-0.3738834	0.0189814	-19.70	0.000
δ_2	0.1282755	0.0342699	3.74	0.000
α_1	0.0008723	0.0002185	3.99	0.000
Sigma u		0.00048		
Sigma e		0.00292		
Rho		0.02633 (fraction of variance due to u_i)		

Source: Estimated based on secondary data collected from www.nseindia.com, 2014

The slope differential effect of medium size firm as compared to small size firm (δ_1) is negative and statistically significant at less than one percent level of significance. This indicates that if volatility increases by one percent for medium size firms then expected return may decreases by approximately 37 per cent. The slope differential effect of large size firm as compared to small size firm (δ_1) is positive and statistically significant at less than one per cent level of significance. This indicates that if volatility increases by one percent for large size firms then expected return may increases by approximately 12 per cent.

Analysis of Expected Return and Firm Size in FMCG Sector

Table 5.1.6: Random-Effects GLS Regression for FMCG Sector

Group variable: PI		Number of observation = 10836		
		Number of groups = 6		
	Within = 0.0434	Observation per group: min = 1560		
R-Square:	Between = 0.2214	Average = 1806.0		
	Overall = 0.0490	Maximum = 2241		
Corr.(u_i, X) = 0 (assumed)		Wald $chi^2(5)$ = 558.49		
Dependent Variable = Return		Prob. > chi^2 = 0.0000		
Variable	Coefficients	Std. Error	t-statistic	P-Value
β_1	0.0042423	0.0003223	13.16	0.000
θ_1	-0.0004012	0.0000492	-8.16	0.000
θ_2	-0.0001127	0.0000492	-2.29	0.022
δ_1	-0.0042348	0.0003287	-12.88	0.000
δ_2	0.2608353	0.0174717	14.93	0.000
α_1	0.000212	0.0000351	6.05	0.000
Sigma u		0.000		
Sigma e		0.0019		
Rho		0.000 (fraction of variance due to u_i)		

Source: Estimated based on secondary data collected from www.nseindia.com, 2014

From Table 5.1.6, it is observed that the intercept term (α_1), which captures the structural factors for large size firms of FMCG sector is significant at one per cent level of significance. This implies there would be a positive expected return (0.021 per cent) from investment in large size firms without any risk. The intercept differential term (θ_1) of small size firm as compared to large size firm is negative and statistically significant at less than one per cent level of significance. This indicates that the intercept differential impact of small size firm as compared to large size firm on expected return decreases by 0.04 per cent in case of FMCG sector. The expected return decreases by 0.019 per cent in case of small size firm. Similarly, the effect of medium size firm as compared to large size firm on expected return (θ_2) is negative and statistically significant at less than five

per cent level of significance. This indicates that the intercept differential impact of medium size firm as compared to large size firm on expected return decreases by 0.011 per cent. The expected return decreases by 0.009 per cent in case of medium size firm.

From Table 5.1.6, it is observed that the estimated coefficient of volatility (β_1) is positive and statistically significant at less than one per cent level of significance. This indicates that there is positive relationship between expected return and volatility small size firms for FMCG sector. This means that if volatility of small size firm increases by one percent then expected return also increases by 0.42 percent. The slope differential effect of medium size firm as compared to small size firm (δ_1) is negative and statistically significant at less than one per cent level of significance. This indicates that if volatility increases by one per cent for medium size firms then expected return may decreases by approximately 0.42 percent. The slope differential effect of large size firm as compared to small size firm (δ_2) is positive and statistically significant at less than 1 percent level of significance. This indicates that if volatility increases by one percent for large size firms then expected return may increases by approximately 26 per cent.

Analysis of Expected Return and Firm Size in IT Sector

From Table 5.1.7, it is observed that the intercept term (α_1), which captures the structural factors for large size firms of IT sector is significant at less than 10 per cent level of significance. This implies there would be a positive expected return (0.032 per cent) from investment in large size firms without any risk. The intercept differential impact of small size firm (δ_1) and medium size firm (δ_2) as compared to large size firm is statistically insignificant. This indicates that small size firm and medium size firm has no statistically significant effect on expected return.

Table 5.1.7: Random-Effects GLS Regression for IT Sector

Group variable: PI		Number of observation = 23953		
		Number of groups = 14		
	Within = 0.0066	Observation per group: min = 87		
R-Square:	Between = 0.1863	Average = 1710.9		
	Overall = 0.0129	Maximum = 2241		
Corr.(u_i, X) = 0 (assumed)		Wald $chi^2(5)$ = 164.30		
Dependent Variable = Return		Prob. > chi^2 = 0.0000		
Variable	Coefficients	Std. Error	t-statistic	P-Value
β_1	0.0007225	0.0005256	1.37	0.169
θ_1	-0.0000374	0.0002377	-0.16	0.875
θ_2	0.0003635	0.0002346	1.55	0.121
δ_1	-.2856624	0.0224829	-12.71	0.000
δ_2	0.0023534	0.00263	0.89	0.371
α_1	0.0003228	0.0001741	1.85	0.064
Sigma u		0.00034		
Sigma e		0.00283		
Rho		0.01420 (fraction of variance due to u_i)		

Source: Estimated based on secondary data collected from www.nseindia.com, 2014

From Table 5.1.7, it is observed that the estimated coefficient of volatility (β_1) is positive and statistically significant at less than 5 percent level of significance. This indicates that there is positive relationship between expected return and volatility of small size firms for IT sector. This means that if volatility of small size firms increases by one percent then expected return also increases by 0.072 percent. The slope differential effect of medium size firm (δ_1) as compared to small size firm is negative and statistically significant at less than one per cent level of significance. This indicates that if volatility increases by one percent for medium size firms then expected return may increases by

approximately 28 per cent. The slope differential effect of large size firm (δ_2) as compared to small size firm is positive but statistically insignificant. This indicates that changes in volatility of large size firms have no statistically significant effect on expected return.

5.2 Sector wise Comparative Analysis:

In section 5.1, we analyze the relationship between expected return and firm size in each sector separately. However, in section 5.2 we make a comparison of the relationship between expected return and firm size among the sectors.

Table 5.1.8 Relationship between Expected Return and Firm Size in Different Sectors

Coefficients	Automobile	Banking	Energy	Financial	FMCG	IT
β_1	0.00050	0.09280**	0.80420*	-0.0155*	0.0042*	0.00072
θ_1	-0.00047***	-0.00005	-0.00091**	-0.00029	-0.0004*	-0.00003
θ_2	-0.00011	-0.00013	-0.00004	-0.00037	-0.0001**	0.0003
δ_1	-0.081*	-0.101**	-0.710*	-0.3738*	-0.0042*	-.2856*
δ_2	-0.003*	-0.024	-0.773*	0.12827*	0.2608*	0.0023
α_1	0.00031***	0.00046**	0.00038	0.00087*	0.0002*	000032* **
Wald chi^2	194 (0.00)	24 (0.00)	164 (0.00)	537 (0.00)	558 (0.00)	164 (0.00)
Observations	17650	23465	22492	24020	10836	23953
Groups	11	11	14	14	6	14

Source: Estimated based on secondary data collected from www.nseindia.com, 2014.

Note: *, ** and *** indicates the level of significance at one, five and ten percent respectively.

From Table 5.1.8 it is observed that the coefficient of volatility (β_1) is statistically significant for banking, energy, financial and FMCG sectors but it is statistically insignificant for automobile and IT sector. The coefficient β_1 is positive for all the sectors except financial sector. A positive and statistically significant coefficient of β_1 indicates that an increase in volatility of small size firms leads to an increase in expected returns. On the other hand, a negative coefficient of β_1 indicates that an increase in volatility of small size firms leads to a decrease in expected returns. The coefficient $\beta 1$ is positive and

statistically significant for banking, energy and FMCG sectors. This indicates that if volatility increases by one per cent for small size firms the expected returns also increases by nine per cent for banking sector, 80 per cent for energy sector and 0.42 per cent for FMCG sector. However, the coefficient β_1 is negative and statistically significant for financial sector. This indicates that if volatility increases by one per cent for small size firms the expected returns decreases by 1.5 per cent for financial sector. In case of small size firm, change in expected returns due to change in volatility is more sensitive for energy sector followed by banking sector. In case of automobile and IT sectors changes in volatility of small size firms have no statistically significant effect on expected returns.

The effect of small size firms on expected returns (as shown by the coefficient θ_1) is negative for all the sectors but statistically significant for FMCG, energy and automobile sectors at one, five and ten percent level of significance respectively. However, it is statistically insignificant for banking, financial and IT sectors. The effect of small size firms on expected returns is relatively higher in energy sector (0.09 percent) followed by automobile (0.047 percent) and for FMCG sector it is relatively lower (0.04 percent). Moreover, for banking, financial and IT sectors small size firms have no statistically significant effect on expected returns.

The effect of medium size firms (as shown by the coefficient θ_2) on expected returns is negative and statistically significant only for FMCG sector. This indicates that if medium size firm increases by one percent then expected returns decreases by 0.01 percent. However, the effect of medium size firms on expected returns is statistically insignificant for all other sectors.

The effect of large size firms (as shown by the intercept term α_1) on expected returns is positive for all sectors and it is statistically significant for all sectors except energy sector. The effect of large size firms on expected returns is relatively higher in financial sector (0.087 per cent) followed by banking sector (0.046 percent) and it is relatively lower for FMCG sector (0.02 percent).

The slope differential effect of medium size firms as compared to small size firms is negative and statistically significant for all sectors. This indicates that if volatility of medium size firms increases then expected returns decreases. However, the rate of decrease in expected return due to increase in volatility is relatively higher in case of energy sector (71 per cent) followed by financial sector (37 per cent) and it is relatively lower in case of FMCG sector.

The slope differential effect of large size firms as compared to small size firms is negative and statistically significant for automobile, banking and energy sectors. This indicates that if volatility of large size firms increases by 1 percent then expected returns decreases by 0.3 percent for automobile sector, 2.4 per cent for banking sector and 77 per cent for energy sector. However, the slope differential effect of large size firms as compared to small size firms is positive and statistically significant for financial and FMCG sector. This implies that if volatility of large size firms increases by one per cent then expected returns also increases by 12.8 per cent for financial sector and 26 per cent for FMCG sector. Moreover, the slope differential effect of large size firms as compared to small size firms is positive but statistically insignificant for IT sector. It implies that change in volatility has no effect on expected return.