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An Empirical Analysis of Higher Moment Capital Asset Pricing Model for Bangladesh Stock Market

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Abstract

Capital Asset Pricing Model (CAPM) describes a relationship which is linear between expected return and risk of an asset. Within the contents of this paper, the higher moments of return distributions for companies listed in the Dhaka Stock Exchange (DSE) market have been inspected for the period of January 2005 to December 2009. The mean-variance CAPM model is extended by taking higher moments-Skewness and Kurtosis. Monthly stock returns from 80 non-financial companies, covering ten sectors (Engineering, Food & Allied, Fuel & Power, Textile, Pharmaceuticals, Services & Real Estate, Cement, Tannery, Ceramic and Miscellaneous) are studied in this research. From the empirical analysis, it is observed that the intercept term is significantly different from zero and insignificant relationship between beta and excess returns both in mean-variance CAPM and higher moment CAPM conditions. This means that the market excess returns provide no explanation for the asset rate of return, whether or not third and fourth moments are considered in the regression model. But, when the higher moments are introduced, the adjusted R-square increases 0.037 to 0.257. It is noticed that the risk premium for co-skewness risk is positive for the period 2005-2009, indicating that the co-skewness risk is compensated in the DSE market for the studied period. Also, the co-kurtosis risk is rewarded by the market. Thus, in describing risk-return relationship in emerging markets like Bangladesh stock market, the higher moment CAPM performs comparatively well.

Keywords: capital asset pricing model, dhaka stock exchange, beta, co-skewness, co-kurtosis

1. Introduction

In the finance literature, Capital Asset Pricing Model (CAPM) is one of the most important developments. CAPM was developed by Sharpe (1964), Lintner (1965) and Mossin (1968) independently. It is the first formulation of mean-variance CAPM, which predicts that the expected return on an asset is linearly related to systemic risk.

Researchers used several methodologies to analysis the CAPM for various stock markets in the world. The studies conducted by Black (1972), Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) were supportive of the standard form of CAPM. But, the standard form of CAPM was rejected, when the portfolio used to proxy for the market is inefficient (Roll, 1977; Ross, 1977). Also, Jegadeesh (1992) and Fama and French (1996) argued that because of the bad proxies of the market portfolio, the failure situation of CAPM is occurred. After 1980s, CAPM was questioned because of some remarkable abnormalities which were reported by Reiganum (1981), Elton, Martin and Rentzler (1984) and Bark (1991). Roll and Ross (1994) and Kandel, Shmuel and Stambaugh (1995) showed that an insignificant relation between risk and expected returns can produce because of the small deviations from efficiency. Isakov (1999) argued that beta may not be always a suitable risk measure in the risk-return relationship. So, financial researchers started to search for a substitute model to describe the risk-return relationship of risky assets because of the large number of empirical evidence against the CAPM. Under the mean-varianve CAPM, only two moments (mean and variance) are considered by the investors and the distribution of asset returns are assumed to be normal. Because of the asymmetric or fat tail distributions in the stock returns, there is a debate about the need of higher moments (skewness and kurtosis) in describing the risk-return relationship (Doan, 2007). Levy (1969) suggested that higher moments cannot be ignored even if they add little information about the shape of the distribution. Rubinstein (1973), Kraus and Litzenberger (1976), Hwang and Satchell (1999) and Ranaldo and Favre (2003) noted that when the market returns are not normal (but skewed or leptokurtic),the standard CAPM is not enough to price equity returns and they recommended for the addition of higher moments (skewness or kurtosis). Very recently, Ang, Chen and Xing (2006), Ang, Hodrick, Xing and Zhang (2006) and Xing, Zhang and Zhao (2010) suggested that the asymmetry of the returns distribution is important for asset pricing.

There were some studies related to higher moment CAPM. Fang and Lai (1997) showed that systematic variance, co-skewness and co-kurtosis contribute to the risk premium of an asset in the U.S. stock market. Dittmar (1999), Hwang and Satchell (1999) and Harvey and Siddique (2000) investigated co-skewness and co-kurtosis in emerging markets and they showed that the higher moment CAPM are better explained than the conventional mean-variance CAPM in emerging markets. Christie-David and Chaudhary (2001) employed the four-moment CAPM on the future markets and noticed that the explanatory power of the return generating process is increased in future markets. Chang, Johnson and Schill (2001) compared the four-moment CAPM with the Fama-French two factors model and observed that the SMB (the difference between the return on a portfolio of small size stocks and the return on a portfolio of large size stocks) and HML (the difference between the return on a portfolio of high book-to-market value stocks and the return on a portfolio of low book-to-market value stocks) become insignificant when the higher order moments are included. Berenyi (2002) applied the four-moment CAPM to hedge fund data and showed that volatility alone is not sufficient in measuring the risk of hedge funds for some investors. Messis, Iatridis and Blanas (2007) showed that in Athens Stock market, positive skewness is preferred by the investors for their portfolios and kurtosis risks is not to be compensated.

In this study, the effects of unconditional skewness and unconditional kurtosis will be examined. The degree of asymmetry of a distribution is represented by Skewness, where positive (negative) skewness depicts a distribution with an asymmetric tail extending toward more positive (negative) values (Harvey & Siddique, 2000). Ignoring skewness risk in predicting stock returns causes the capital asset pricing model to devalue the risk of returns (Doan, 2007). Kurtosis portrays the relative peakness or flatness of a distribution compared with the normal distribution. Kurtosis higher (lower) than three indicates a distribution more peaked (flatter) than a normal distribution (Harvey & Siddique, 2000). According to Hood, John, Nofsinger and Kenneth (2009) the investors dislike negative skewness and excess kurtosis because the negative skewness increases weight in the lower tail at the expense of the upper tail and the excess kurtosis increases weight in both tails at the expense of the central area of the distribution.

Research on emerging markets suggested that methods of conventional finance such as mean-variance CAPM are highly misleading (Hwang & Satchell, 1999). But, a sound and well tested pricing model can contribute more to emerging markets for their sound operation. The objective of this study is to examine the higher moment CAPM for emerging markets, especially for Dhaka Stock Exchange (DSE) in Bangladesh. In DSE, there were several studies had been conducted. In order to test whether CAPM is a good indicator of asset pricing in Bangladesh, Rahman, Baten, and Alam (2006) considered Fama and French (1992) methodology and found that the variables have a significant relationship to the stock return. Basher, Hassan and Islam (2007) found that the DSE equity returns show negative skewness, excess kurtosis and deviation from normality. There are some actions (Hussain, Chakraborty, & Kabir, 2008) which can improve the efficiency of the DSE market such as: ensuring asymmetric information among all investors, proper implication of rules of regulatory commission and introducing sophisticated means of investment and tools. Mobarek, Mollah, Sabur and Bhuyan (2008) searched for the independence and randomness in the return series of DSE market by using both non-parametric and parametric tests and noticed that the security returns do not follow random walk model. Alam, Yasmin, Rahman, and Uddin (2011) found that the frequency distribution of the stock prices in DSE does not follow a normal or uniform distribution.

2. Methodology

2.1 Data

The data used in the study consists of 80 non-financial companies, which are traded on the Dhaka Stock Exchange for the period of 1st January 2005 to 31st December 2009. Here, the period of research was 60 months, because many studies (for example, Dimson & Marsh, 1983) used an estimation period of 60 months when using monthly returns. This study excluded the financial companies and considered only the non-financial companies because the reporting system of financial companies is quite different from non-financial companies (Mollah, 2009). Monthly data was used for all variables, because the daily data, though better for estimating risk-return relationship, is very noisy (Basu & Chawla, 2010). The rate of return for each security was calculated as: *Return* $= ln (P_t) - ln (P_{t-1})$, where P_t = closing price at period *t*; P_{t-1}= closing price at period *t-1*and *ln* = natural log. The company's dividend, bonus and right issues were not adjusted (Lakonishok & Smidt, 1988; Fishe, Gosnell, & Lasser, 1993), logarithm returns were taken (Strong, 1992) and individual securities were used rather than portfolios for the analysis (Kim, 1995; Kaplanski, 2004). For a proxy of the market portfolio, the DSI Index was used and for the proxy of the risk-free asset, Bangladesh government 3-Month T-bill rate was used.

2.2 Normality Test of Returns

It has long been well documented that stock returns do not follow a normal distribution. The returns often have "fat tails" and more peaked than a normal distribution (Brown & Matysiak, 2000). Bekaert, Erb, Harvey and Viskanta (1998) found that the majority of emerging country's stock returns are not normally distributed. The reasons of non-normal return distributions may be due to illiquidity, lack of divisibility, and low information transparency (Ranaldo & Favre, 2003).

To check the normality of a sample's distribution, the prominent test: Jarque-Bera test was considered in this research. The Jarque-Bera test for normality is now presented by considering the following null hypothesis

H_0: Returns series follow the normal distribution

H_1: Returns series do not follow the normal distribution

The test statistic of JB is defined as

$$JB = \frac{n}{6}\left[S^2 + \frac{K^2}{4}\right]$$

where n is the number of observations; S is the skewness, and K is the excess kurtosis. This test follows the χ^2distribution with 2 degrees of freedom. The 10%, 5% and 1% critical value for χ^2 is 4.605, 5.991 and 9.210 respectively. The null hypothesis of normality is rejected if the calculated test statistic exceeds a critical value from the $\chi^2_{(2)}$ distribution.

2.3 Estimating the Mean-Variance CAPM

According to the CAPM developed by Sharpe (1964), Lintner (1965) and Mossin (1968) returns can be explained through the following equation:

$$R_{it} = R_{ft} + \beta_i (R_{mt} - R_{ft}) \quad (1)$$

where, R_{it} is the rate of return on company *i* at time *t*, R_{ft} is the rate of return on a risk free asset at time *t*, R_{mt} is the rate of return on the market index at time *t* and β_i is the beta of company *i*, which can be expressed by $Cov(R_i, R_m)/Var(R_m)$. CAPM is estimated using the two-step estimation procedure: time series and cross-sectional estimation procedure (Fama & MacBeth, 1973). In the first stage, following regression is used to estimate systematic risk:

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + e_{it} \quad (2)$$

where e_{it} is the random disturbance term in the regression equation at time *t*. Equation (2) is estimated using ordinary least squares (OLS). In the second stage, following regression is used:

$$\bar{r}_i = \gamma_0 + \gamma_1 \beta_i + e_i \quad (3)$$

where $\bar{r}_i$ refers to the average excess returns for company *i* over the whole sample, β_i is the estimate of the systematic risk contained in a particular company *i* and is obtained from the first stage regression in Equation (2), e_i are the regression residuals. γ_0 and γ_1 are the parameter estimates.

2.4 Estimating the Higher Moment CAPM

From the results of the normality tests, it is observed that the empirical stock returns distribution is asymmetric and leptokurtic and for that reason the mean-variance CAPM model is to incorporate the co-skewness (third moment) and co-kurtosis (fourth moment) factors. As suggested by Kraus and Litzenberger (1976), Homaifar and Graddy (1988) and Dittmar (1999), the following equation will be derived by introducing the higher moments:

$$\bar{r}_i = \gamma_0 + \gamma_1 \beta_i + \gamma_2 \delta_i + \gamma_3 \kappa_i + e_i \quad (4)$$

where the parameter β_i denotes the covariance, δ_i represents co-skewness and κ_i is co-kurtosis of asset i which are time series regression coefficients of the following model:

$$R_{it} - R_{ft} = \alpha_i + \beta_i \left(R_{mt} - R_{ft}\right) + \delta_i \left(R_{mt} - R_{ft}\right)^2 + \kappa_i \left(R_{mt} - R_{ft}\right)^3 + e_{it} \quad (5)$$

The slope coefficients of the cubic CAPM model given in the above Equation (5) are used as an explanatory variable in the cross-section Equation (4) to estimate the corresponding risk premium. The coefficient γ_0 is intercept term and γ_1, γ_2, γ_3 are risk premiums for covariance risk, co-skewness risk and co-kurtosis risk. γ_1, γ_2 and γ_3 measure the required returns demanded by investors for taking on an additional unit of covariance, co-skewness risk and co-kurtosis risk.

3. Results and Discussion

3.1 Summary Statistics

Table 1. The first four momentsof monthly stock returns ofthe studied companies listed in DSE

Company	Group	Mean (%)	S.D.(%)	Skewness	Excess Kurtosis	Jarque-Bera
Aftab Automobiles	Engineering	1.99%	16.57%	0.9544	2.0683	19.8030*
Aziz Pipes	Engineering	3.37%	14.83%	1.0122	1.0575	13.0420*
Olympic Industries	Engineering	3.19%	14.11%	0.5202	0.6073	3.6280@
Bangladesh Lamps	Engineering	1.33%	10.36%	-0.5972	2.1524	15.1495*
Eastern Cables	Engineering	1.65%	15.83%	1.5833	4.2629	70.5014*
Monno Jutex	Engineering	1.97%	14.79%	2.6229	11.1005	376.8514*
Monno Staflers	Engineering	1.49%	16.81%	1.9489	5.7975	122.0096*
Singer Bangladesh	Engineering	0.88%	10.93%	2.1920	10.3109	313.8320*
Atlas Bangladesh	Engineering	0.23%	13.75%	-1.0817	1.6765	18.7272*
BD.Autocars	Engineering	3.55%	18.77%	1.2801	2.1842	28.3127*
Quasem Drycells	Engineering	1.87%	12.01%	0.0152	0.5853	0.8589@
Renwick Jajneswar	Engineering	3.56%	20.88%	1.2259	1.8501	23.5857*
National Tubes	Engineering	-0.57%	15.72%	-1.8637	6.1960	130.7100*
Anwar Galvanizing	Engineering	1.95%	13.87%	0.2252	0.3926	0.8926@
Kay & Que	Engineering	1.38%	18.08%	1.5602	3.6496	57.6396*
Rangpur Foundry	Engineering	2.52%	13.56%	1.7739	6.7860	146.5921*
National Polymer	Engineering	2.38%	17.58%	-0.0587	2.9152	21.2799*
Alpha Tobacco	Food & Allied	-0.19%	39.73%	-0.1536	19.0334	905.9124*
Apex Foods	Food & Allied	0.85%	14.40%	1.0358	3.1213	35.0858*
Bangas	Food & Allied	3.23%	15.08%	2.1931	6.6058	157.1875*
BATBC	Food & Allied	1.79%	12.01%	0.9612	3.3978	38.1021*
National Tea	Food & Allied	2.12%	13.15%	2.1707	7.6097	191.8886*
Zeal Bangla Sugar	Food & Allied	2.91%	20.62%	2.1918	6.6453	158.4397*
Bangladesh Plantation	Food & Allied	1.85%	6.28%	2.5622	12.3124	444.6393*
AMCL (Pran)	Food & Allied	1.59%	11.02%	0.7188	1.5064	10.8399*
Shaympur Sugar	Food & Allied	2.80%	18.48%	1.0593	0.9730	13.5870*
Rahima Food	Food & Allied	4.08%	17.90%	1.8367	4.2343	78.5589*
Meghna Pet Industries	Food & Allied	3.635%	20.93%	0.8177	0.6740	7.8221**

Meghna Condensed Milk	Food & Allied	4.71%	20.50%	0.4850	0.2141	2.4667@
Beach Hatchery Ltd.	Food & Allied	3.58%	17.47%	1.4897	4.3441	69.3687*
BOC Bangladesh	Fuel & Power	2.02%	10.69%	0.7239	0.8007	6.8431**
Padma Oil Co.	Fuel & Power	0.86%	19.93%	-2.3364	9.3252	271.9837*
Bd. Welding Electrodes	Fuel & Power	4.08%	26.33%	2.8465	13.8189	558.4344*
Stylecraft	Textile	1.48%	11.31%	2.8904	10.3346	350.5549*
Saiham Textile	Textile	2.47%	15.21%	0.6608	1.3802	9.1291**
Desh Garmants	Textile	2.52%	16.76%	1.1316	3.9576	51.9613*
Dulamia Cotton	Textile	1.70%	19.68%	1.1025	2.1155	23.3439*
Tallu Spinning	Textile	1.08%	14.14%	-0.0834	0.7467	1.4635@
Bextex Limited	Textile	1.21%	17.67%	1.0621	1.4234	16.3454*
Apex Spinning.	Textile	1.56%	13.25%	1.2670	3.6113	48.6549*
Delta Spinners	Textile	3.11%	13.16%	1.2917	3.7634	52.0922*
Sonargaon Textiles	Textile	2.57%	14.52%	0.3194	1.5128	6.7418**
Prime Textile	Textile	2.99%	13.11%	0.5822	1.5656	9.5173*
Alltex Ind. Ltd.	Textile	0.79%	15.05%	1.2020	4.5504	66.2115*
H.R.Textile	Textile	2.24%	12.46%	0.5269	1.1230	5.9291***
Square Textile	Textile	-0.36%	8.69%	0.2364	2.0092	10.6507*
Metro Spinning	Textile	2.34%	14.74%	-0.3609	3.1592	26.2543*
Ambee Pharma	Pharmaceuticals	1.93%	15.35%	3.8230	22.9213	1459.6194*
Beximco Pharma	Pharmaceuticals	0.88%	13.33%	0.4210	2.2797	14.7647*
Glaxo SmithKline	Pharmaceuticals	2.41%	14.12%	0.4826	1.0537	5.1050***
ACI Limited.	Pharmaceuticals	2.59%	12.79%	0.5787	4.1257	45.9025*
Renata Ltd.	Pharmaceuticals	2.21%	9.29%	0.1272	0.6450	1.2019@
Reckitt Benckiser Ltd.	Pharmaceuticals	4.15%	12.76%	1.2923	2.3125	30.0678*
Therapeutics	Pharmaceuticals	2.12%	23.66%	1.5604	4.0863	66.0917*
Pharma Aids	Pharmaceuticals	4.51%	14.90%	1.1330	1.7996	20.9336*
The Ibn Sina	Pharmaceuticals	1.15%	10.67%	0.8376	1.7313	14.5087*
Libra Infusions Limited	Pharmaceuticals	1.79%	13.22%	0.7728	0.5946	6.8552**
Orion Infusion	Pharmaceuticals	2.75%	15.09%	1.7192	5.9946	119.3948*
Square Pharma	Pharmaceuticals	-0.46%	13.88%	-0.0362	2.4403	14.9006*
Beximco Synthetics	Pharmaceuticals	1.58%	17.77%	1.1615	2.7206	31.9940*
Heidelberg Cement Bd.	Cement	1.06%	12.12%	-0.0318	1.4409	5.2008***
Confidence Cement	Cement	3.59%	14.25%	0.4253	0.5221	2.4904@
Meghna Cement	Cement	2.20%	13.16%	0.7224	1.9094	14.3336*
Niloy Cement	Cement	1.54%	16.07%	1.4688	4.3019	67.8401*
Aramit Cement	Cement	3.60%	16.12%	0.8195	0.8605	8.5670**
Padma Cement	Cement	3.05%	14.87%	1.9533	3.7557	73.4173*
Lafarge Surma Cement	Cement	0.25%	9.13%	0.9773	2.1667	21.2875*
Samorita Hospital	Services & Real Estate	1.99%	13.73%	1.4126	5.2386	88.5595*
Information Services	Services & Real Estate	0.90%	18.44%	-1.1128	3.1321	36.9083*
BDCOM Online Ltd.	Services & Real Estate	1.57%	18.09%	1.0491	5.4623	85.5998*

In Tech Online Ltd.	Services & Real Estate	0.67%	16.81%	1.7625	8.1269	196.1809*
Agni Systems Ltd.	Services & Real Estate	1.16%	15.98%	0.4776	0.7186	3.5721@
Apex Tannery	Tannery	2.19%	14.56%	1.1754	3.0154	36.5474*
Bata Shoe	Tannery	1.68%	9.48%	0.2394	1.7578	8.2981**
Apex Adelchy Footwear	Tannery	2.55%	17.46%	2.2881	10.3583	320.5892*
Samata Leather	Tannery	1.80%	19.47%	0.6867	0.8088	6.3507**
Legacy Footwear	Tannery	2.91%	17.37%	0.6611	0.5495	5.1255***
Monno Ceramic	Ceramic	0.59%	13.85%	1.6127	5.3855	98.5179*
Fu-Wang Ceramic	Ceramic	2.20%	14.18%	0.7700	2.6045	22.8875*
Beximco	Miscellaneous	3.50%	20.43%	1.1615	2.7206	31.9940*
Market Return		1.07%	9.02%	-0.2012	1.4210	5.4530***

Table 1 repoeted the first four moments of monthly stock returns of 80 non-financial companies and market return of DSE market. From Table 1, it was cleared that the average returns varied from -0.57% (National Tubes) to 4.71% (Meghna Condensed Milk). The skewness ranged from -2.33 (Padma Oil) to 3.82 (Ambee Pharma). Excess kurtosis could be as high as 22.92, ranging from 0.21 (Meghna Condensed Milk) to 22.92 (Ambee Pharma). The results reported in column 5 showed that out of the 80 companies, 69 companies exhibited positive skewness and 11 companies exhibited negative skewness. The values of excess kurtosis presented in column 6 indicated that the monthly stock returns of all companies were leptokurtic behaviour, which means that the curve was relatively more peaked than the normal curve. This findings are consistent with the findings of Mandelbrot (1963), Mandelbrot and Taylor (1967) and Campbell, Lo and Mackinlay (1998) as they showed that stock returns exhibit positive excess kurtosis (fat tail distributions). Finally, the conclusions of Bekaert et al. (1998) study match with this research as they provided evidence that out of 20 emerging stock markets, majority markets have the positive skewness and excess kurtosis. The estimates of the Jarque-Bera (JB) test given in the last column were showing that 72 stocks (out of 80 stocks) deviate from normality. Thus the main features of the studied data were: returns were positive, volatile, asymmetric and had fat tails.

3.2 Ordinary Least Squares (OLS) Estimates of Mean-Variance CAPM

Table 2. OLS Estimates of Mean-Variance CAPM

Variables	Coefficients	S.E.	t-value	Adj. R^2
Constant	-0.026*	0.002	-12.457	0.037
Beta	-0.016@	0.008	-1.999	

*, **, *** Significance level at 1, 5, and 10%, respectively, @ indicates insignificant, S.E. = Standard Error

The critical condition of CAPM is that the intercept term (γ_0) should not be significantly different from zero and there would be a positive trade off between market risk and return. But from Table 2, it was seen that the intercept term was significantly different from zero, which means that the expected retums on the zero-beta portfolio were significantly different from the risk-free rate. Also, there was an insignificant negative relationship between market risk and return, whereas for emerging markets, Thomas (1995) found a positive and insignificant risk-return association for the Bombay Stock Exchange and Mecagni and Sourial (1999) found a positive and significant risk-return relationship for Egyptian Stock Exchange. Hence, based on the intercept and slope criterion, the CAPM hypothesis could clearly be rejected for the studied individual companies in the DSE market for the reference year.

3.3 Ordinary Least Squares (OLS) Estimates of Higher Moment CAPM

Table 3. OLS Estimates of Mean-Variance-Skewness CAPM

Variables	Coefficients	S.E.	t-value	Adj. R^2
Constant	-.030*	.003	-12.050	
Beta	-.011@	.008	-1.464	.113
Skewness	.003*	.001	2.779	

*, **, *** Significance level at 1, 5, and 10%, respectively, @ indicates insignificant, S.E. = Standard Error

Table 4. OLS Estimates of Mean-Variance-Kurtosis CAPM

Variables	Coefficients	S.E.	t-value	Adj. R^2
Constant	-.023*	.003	-8.877	
Beta	-.019@	.008	-2.402	.070
Kurtosis	-.001***	.000	-1.962	

*, **, *** Significance level at 1, 5, and 10%, respectively, @ indicates insignificant, S.E. = Standard Error

Table 5. OLS Estimates of Higher Moment CAPM

Variables	Coefficients	S.E.	t-value	Adj. R^2
Constant	-0.027*	0.002	-10.874	
Beta	-0.015@	0.007	-2.105	0.257
Skewness	0.006*	0.001	4.514	
Kurtosis	-0.001*	0.0003	-3.996	

*, **, *** Significance level at 1, 5, and 10%, respectively, @ indicates insignificant, S.E. = Standard Error

In order to examine the effect of higher moments on the asset pricing model, the third and fourth moments were incorporated in the mean-variance CAPM. The estimates of the mean-variance-skewness CAPM, mean-variance-kurtosis CAPM and mean-variance-skewness-kurtosis CAPM were reported for comparison in Table 3, Table 4 and Table 5 respectively. The intercept term was significantly different from zero in all cases and there was an insignificant negative relationship between systematic risk and the returns in the higher moment condition also.

All investors are aversion to variance and kurtosis and preference for (positive) skewness (Kraus & Litzenberger, 1976). They are compensated in higher expected return for taking the systematic variance and the co-kurtosis risks whereas sacrifice the expected excess return for taking the benefit of increasing the co-skewness (Fang & Lai, 1997). From Table 3 and Table 5, it was seen that the co-skewness coefficients were statistically significant at 1% level of significance. A significant value of γ_2 indicated that co-skewness was priced by the market and the excess returns of DSE market had a non-linear relationship with the market portfolio. This means that these assets will significantly increase or decrease market skewness if added to the market portfolio. The finding of this research rejected the usual market model and demonstrated the validity of the quadratic market model as a possible extension.

Since investors have preference for high skewness, negative market skewness is considered as risk and is expected to be rewarded with a positive skewness premium (Javid & Ahmad, 2008). Theoretically, when the market returns are positively (negatively) skewed, the market premium for an asset's co-skewness with the market, γ_2, is negative (positive) (Lim, 1989). Therefore, from the results given in Table 3 and Table 5, the risk premium for co-skewness γ_2 was positive and market was negatively skewed (-0.2012), which indicated that co-skewness risk was compensated in the Dhaka stock market. This finding is consistent with the findings of Messis et al. (2007), Javid (2009) and Kraus and Litzenberger (1976) studies.

The argument for kurtosis is high kurtosis (or fat tails) is a negative investment incentive and the corresponding risk premium γ_3 is expected to be positive (Javid, 2009). A positive co-kurtosis coefficient means that the asset is adding kurtosis to the market portfolio. In contrast, an asset with a negative co-kurtosis coefficient means that the asset will decrease the market portfolio's kurtosis (Liow & Chan, 2004). From the results of the Table 4 and Table 5, it was noticed that the risk premium for co-kurtosis was significant but did not had the expected sign as stock returns are negatively correlated with kurtosis. It contradicts the expectation on the relationship between kurtosis and returns for risk-averse investors, who would expect to get higher returns for higher kurtosis. The findings of this research suggested that investors were not averse to kurtosis in their portfolios and did not require higher excess rates of returns for bearing the higher co-kurtosis risks. Similar results were found by Tang and Shum (2003) for testing the Brazilian stock market and Messis et al. (2007) for testing the Athens stock market.

With the introduction of the higher moments (co-skewness and co-kurtosis) as additional explanatory variables in the regressions of stock returns, the adjusted R^2 was increased 0.037 to 0.257. The results showed that both co-skewness and co-kurtosis were priced in the DSE market. The adjusted R^2 is higher when skewness was introduced in the model than kurtosis. So, the model with skewness was better than the model with kurtosis because it exhibited better performance (Groenewold & Fraser, 1997).

4. Conclusion

This paper investigated the importance of higher moments of return distributions in capturing the variation of average stock returns for companies listed in the DSE market. The empirical findings indicated that Sharpe-Lintner standard CAPM is inadequate for Bangladesh stock market. The asset returns of DSE market deviates from normality indicated that investors were concerned about the higher moments of return distribution and this study provided strong support for the inclusion of terms that represent co-skewness and co-kurtosis. It was also found that the coefficient of determination increased as terms for coskewness and cokurtosis were included. It was shown that, in the presence of skewness and kurtosis in asset return distribution, the expected excess rate of return was related to the co-skewness and co-kurtosis but not related to the systematic variance. Therefore, non-linear asset pricing models are superior to the standard model in explaining risk return relationship. It is important for future research to develop a theoretical asset pricing model which addresses the non-normality of the return distribution.

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