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Optimal Portfolio Construction: Evidence from Dhaka Stock Exchange in Bangladesh

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The main purpose of this paper is to construct an optimal portfolio by using Sharpe's single-index model. For this purpose the monthly closing prices of 164 companies listed in Dhaka Stock Exchange (DSE) and DSE all share price index for the period of July 2007 to June 2012 have been considered. The proposed method formulates a unique cut off point (Cut off rate of return), selects stocks having excess return to beta ratio surpassing this cut off point, and determines the percentage of investment in each of selected stocks. The optimum portfolio consists of thirty three stocks selected out of 164 stocks, giving the return of 6.17%. The findings of this paper will be useful for policy makers, all kinds of investors, corporations and other financial market- participants.

Field of Research: Portfolio Analysis

1. Introduction

It's a complicated task of selecting good investments by considering the trade-off between risk and return along with the combination of various types of investments for the investors. A rational investor always seeks to minimize risks and maximize returns on his investment in an optimal portfolio. For this purpose investors ought to maximize the level of return at a given level of risk and alternatively to minimize the level of risk at a given level of return. This is done through the construction of portfolio of assets which is subject to the investor's portfolio. The study's significance arises from the fact that the application of the fundamental models develops an offer to investors for making decision in the choice of optimal portfolios in the Dhaka Stock Exchange (DSE).

The rational of the study is to apply theoretical framework of portfolio management on a real world scenario and to form a well-balanced optimized and diversified portfolio of stocks. Varian (1993) succinctly reviewed the history of modern portfolio theory as Markowitz's groundbreaking research on portfolio optimization was published in March 1952 in an article titled "Portfolio Selection" in the Journal of Finance. Implementation of Markowitz model is much more time-consuming and more complex by the number of estimates required. The sheer number of inputs is staggering. Recognition of this has motivated the search for the development of models. Although the majority of the studies were carried out in developed countries, only a limited number of studied were conducted in developing countries. The study attempts to find out the optimal portfolio using single index model.

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1.1 Problem Statement

The problem statement for this research is to assist investors to make their investment decision using single index model to avoid problems like difficulty in data input, educating portfolio managers, and time-cost consideration.

1.2 Objectives of the Study

The study has been conducted to construct an optimal portfolio using Single index Model considering no short-sales. In addition, short-sales are not allowed in Bangladesh. And the study has been conducted on individual securities listed in Dhaka Stock Exchange (DSE). The objectives of this study are:

a. Risk-return analysis of individual securities listed in DSE.
b. Allocate investment in different stocks considering risk-return criteria.
c. Construct optimal portfolio using Single index Model.
d. Assist investors in portfolio selection process to make the right choice.

1.3 Structure of the Paper

The text is divided into six parts: Part One, 'Introduction', introduces the importance of trade-off between risk and return. Hence, background of the problem was given briefly in this part; followed by Problem Statement, Objectives of the Study of this research. Part Two, 'Literature review', has been executed in two phases; it discusses, firstly, overview of Dhaka Stock Exchange; secondly, portfolio Analysis. Part Three, 'Methodology and Data', explains data source and methodology. Part Four, 'Data Analysis and Findings', discusses the results of the study. Part Five, 'Conclusion', concludes the research result as well as the limitation of the research. Part Six, 'References', provide the lists of full bibliographical details and their journal titles.

2. Literature Review

2.1 Overview of Dhaka Stock Exchange (DSE)

235 companies traded on DSE until June 2012. In 2010-2011, the volume of trade of listed securities increased by manifold at the Dhaka Stock Exchange. In 2010-2011, a total of 1969 crore and 52 lakh securities were traded on the Dhaka Stock Exchange, the value of which stands at Tk. 3 lakh 25 thousand 915 crore. On the other hand, 1012 crore and 84 lakh securities were traded in 2009-10, the value of which was Tk. 256,349 crore. The number of trading days was 240 days in 2010-2011, which was 244 days in 2009-2010. The average number of securities traded was 8.20 crore in 2010-2011 and average transaction was Tk. 1357 crore 98 lakh. On the other hand, 4.15 crore securities were traded in 2009-2010 and average transaction was Tk. 1050 crore and 61 lakh. DSE's all-share price index was 5160.05 points at the year ended on June 30, 2010 which lost 66.86 points and stood at 5093.19 points on June 30, 2011. The DSE's all-share price index stood highest 7383.94 points on December 5, 2010. Nine new companies were listed at the DSE during 2010-11 raising the number of listed companies to 232.

In addition, The DSE's market capitalization to GDP ratio was 41.10 percent at the year ended on June 30, 2011. Collecting tax at source on share transaction from its member companies, the Dhaka Stock Exchange deposited Tk. 325.91 crore in fiscal year 2010-2011 and Tk. 128.17 crore in fiscal year 2009-2010, to the government exchequer.

2.2 Portfolio Analysis

Markowitz (1952 and 1959) performed the pioneer work on portfolio analysis. The major assumption of the Markowitz's approach to portfolio analysis is that investors are basically risk-averse. This means that investors must be given higher returns in order to accept higher risk. Markowitz then developed a model of portfolio analysis. The three highlights of this model are normally; the two relevant characteristics of a portfolio are its expected return and some measure of the dispersion of possible returns around the expected return; rational investors will be chosen to hold efficient portfolios, those that maximize expected returns for a given level of risk or, alternatively, minimize risk for a given level of return.

Markowitz (1952) and Tobin (1958) showed that it was possible to identify the composition of an optimal portfolio of risky securities, given forecasts of future returns and an appropriate covariance matrix of share returns. James and Farrell (1997) stated that it is theoretically possible to identify efficient portfolios by analyzing of information for each security on expected return, variance of return, and the interrelationship between the return for each security and for every other security as measured by the covariance.

Sharpe (1963) attempted to simplify the process of data input, data tabulation, and reaching a solution. He also developed a simplified variant of the Markowitz model that reduces data and computational requirements. Although Markowitz model was theoretically elegant its serious limitation was the sophisticated and volume of work was well beyond the Markowitz model. William Sharpe (1964) has given model known as Sharpe Single Index Model (SIM) which laid down some steps that are required for construction of optimal portfolios.

Bowen (1984) noted that the Markowitz model required large volumes of data and found that it was difficult to estimate large number of covariance and concluded that semantic and statistical barriers exist that prevent the average businessman from coming to grips with the approach. Michaud (1989) said that Markowitz optimization is not used more in practice, despite its theoretical success due to the conceptually demanding nature of the theory; the fact that most investment companies are not structured to use a mean-variance optimization approach; and Anecdotal evidence that portfolio managers find the composition of optimized portfolios counter-intuitive.

Elton, Gruber and Padberg (1976) suggested using single index model to avoid problems like difficulty in data input, educating portfolio managers and time-cost consideration. Haugen (1993) stated that Index models can handle large population of stocks. They serve as simplified alternatives to the full-covariance approach to portfolio optimization. Although the SIM model offers a simple formula for portfolio risk, it also makes an assumption about the process generating security returns. The accuracy of the formula of the SIM model for portfolio variance is as good as the accuracy of its assumption.

According to Terol et al. (2006) Markowitz model is a conventional model proposed to solve the portfolio selection problems by assuming that the situation of stock markets in the future can be characterized by the past asset data. However, it is difficult to ensure the accuracy of this traditional assuming because of the large number of extensions to problems of the traditional portfolio selection. As for SIM model, it includes fuzzy betas obtained not only from statistical data but also from expert knowledge. In addition, Briec & Kerstens (2009) stated that Markowitz model contributes in geometric mean optimization advocated for long term investments. On the other hand, the SIM models are no longer good approximations to multi period.

As seen by Frankfurter et al. (1976) the SIM approach is based on Markowitz model. However, this approach adds the simplifying assumption that returns on various securities is related only through common relationship with some basic underlying factors. According to this study, under conditions of certainty, the Markowitz and SIM approaches will arrive at the same decision set in the experiment. These results demonstrate that under conditions of uncertainty, SIM approach is advantageous over the Markowitz approach. It was found that variation in performance is explained in terms of the two essential differences in the models. First, fewer and different estimators are used in the SIM model to summarize past history. Second, the linear assumption of the SIM model does not necessarily hold. They finally found that in experiments, the SIM process performs worse than Markowitz process, and gives superior results when only short data histories are available. Omet (1995) argued that the two models are similar. SIM model can be used, which is more practical than the Markowitz model in generating ASE efficient frontier.

Dutt (1998) used Sharpe single index model in order to optimize a portfolio of 31 companies from BSE (Bombay Stock Exchange).Singh (2007), Kumar (2011), and Elton et al. (1976) in their studies tested the efficiency of Sharpe Single Index Model to make optimum portfolio selection. Their results are similar as all concluded that Single index model is efficient in constructing optimal portfolio and portfolio return is much higher than the portfolio variance. Paudel and Koirala (2006) checked the efficiency of Sharpe portfolio optimization model using a sample of 30 stocks traded in Nepalese Stock market from 1997-2006 and identified that portfolio beta is significantly lower than the market beta.

Chitnis (2010) optimized two portfolios using single index model, compared them, and he found out that portfolios tend to spread risk over many securities and thus help to reduce the overall risk involved. “The greater the portfolio’s Sharpe’s ratio, the better is its performance.”

Nanda, Mahanty, and Tiwari (2012) selected stocks from the clusters to build a portfolio, minimizing portfolio risk and compare the returns with that of the benchmark index i.e. Sensex. Saravanan and Natarajan (2012) used Sharpe single index model in order to construct an optimal portfolio of 4 companies from NSE (National Stock Exchange of India) and used NSE NIFTY as market index. Meenakshi and Sarita (2012) stated that Sharpe's single index model is of great importance and the framework of Sharpe's single index model for optimal portfolio construction is very simple and useful.

Most of the studies were carried out in developed countries, only a few numbers of studies were conducted in developing countries especially in Bangladesh. Kamal

(2012), during and after the bubble burst no stock took part on an optimal portfolio. This is because of that the most stocks were as risky as market and market return was negative after bubble burst. Hence stocks were selected randomly listed in Dhaka Stock Exchange to construct a well rationalized and diversified portfolio using single index model. The study covers only 16 securities to conclude a decision. It covers only 6.80% data that is quite unsatisfactory to make an investment decision.

3. Methodology and Data

3.1 Data Source

This paper aims at constructing an optimal portfolio by using Sharpe's single-index model. For this purpose monthly closing price of the shares, dividend information and monthly closing index value of the benchmark market index (DSE all share price index) have been used for the period from July 2007 to June 2012. They were collected from Dhaka Stock Exchange. This study takes 164 companies listed in Dhaka Stock Exchange (DSE). The study has used secondary data because it pertains to historical analysis of reported financial data. Auction of 91 days Treasury bill has been used as proxy for risk-free rate sourced from “Bangladesh Bank”. The collected data were consolidated as per study requirements. Various statistical tools have been used to analyze data through Microsoft Excel software.

Table 1: Sector-wise Percentage of Data Coverage

Name of the Industry	Total Number of Companies	No. of Companies	% of Data Coverage
Bank	30	27	90.00%
Financial Institutions	22	13	59.09%
Engineering	23	18	78.26%
Food & Allied	16	9	56.25%
Fuel & Power	14	7	50.00%
Jute	3	1	33.33%
Textile	26	17	65.38%
Pharmaceuticals & Chemicals	20	14	70.00%
Paper & Printing	1	1	100.00%
Services & Real Estate	4	2	50.00%
Cement	6	4	66.67%
IT - Sector	6	4	66.67%
Tannery Industries	5	4	80.00%
Ceramic Industry	5	3	60.00%
Insurance	45	32	71.11%
Miscellaneous	9	8	88.89%
Total	**235**	**164**	**69.79%**

From the table 1 it can be seen that among 235 companies 164 companies are selected due to the reason of the availability of data within the time frame (July 2007 to June 2012). The companies that are listed and traded but stopped operations during the time frame are excluded. It has covered 69.79% data and it can be said that data coverage is moreover satisfactory to make an investment decision.

3.2 Methodology

3.2.1 Rationale of using Single Index Model

Markowitz's efficient portfolio combines securities with a correlation of negative one in order to reduce risk in the portfolio to gain optimum return. In order to study N-security portfolio using Markowitz model, the inputs of expected returns and variances of returns of individual securities and covariance's of returns among them are required. As a result, Markowitz's model requires [N (N+3)]/2 separate pieces of information for identification of efficient portfolio. Hence the model is complex in nature. William Sharpe contributed to Markowitz's work and found out a more simplified model, where he considered the fact that relationship between securities occurs only through their individual relationships with some index or indices. As a result of which the covariance data requirement reduced from (N^2-N)/2 under Markowitz model to only N measures of each security as it relates to the index. Overall, the Sharpe model requires [3N+2] separate pieces of information as against [N (N+3)]/2 for Markowitz Model.

3.2.2 Sharpe's Single Index Model

William Sharpe (1963) studied Markowitz's research and worked on simplifying the calculations in order to develop a practical use of the model. The single index model assumes that co-movement between stocks is due to movement in the index. The basic equation underlying the single index model is:

$$R_i = \propto_i + \beta_i R_m + e_i$$

Where R_i is expected return on security *i*; $\propto_i$ is intercept of the straight line or alpha co-efficient (Constant); β is slope of straight line or beta co-efficient; R_m is the rate of return on market index and e_i is error term.

To analyze return characteristic of the stocks, the monthly mean return is calculated. The monthly return on each stock is calculated as follows:

$$R_{it} = \frac{p_{it}}{p_{it-1}} - 1$$

Where R_{it} is the monthly return on stock *i* at time *t*; P_{it} is the monthly closing price of the stock i at time *t*; and p_{it-1} is the monthly closing price of the stock *i* at time *t-1*.

The excess return is the difference between the expected return on the stock and the riskless rate of interest such as the rate on a Treasury bill(here 11.25%p.a is considered as risk free rate based on the 91 days treasury bills rate). For the purpose of analyzing risk characteristic of the stocks, systematic risk or beta is calculated. Beta measures how sensitive a stock's return due to its relationship with the return on the market.

$$\beta_i = \frac{\sigma_{im}}{\sigma_m^2}$$

Where σ_{im} in the covariance of the stock I with the market and σ_m^2 is the variance of the market return. To calculate market return DSE all share price index data is used.

The excess return to beta ratio measures the additional return on a security (excess of the riskless assets return) per unit of systematic risk or non-diversifiable risk. The selection of any stock is directly related to its excess return-beta ratio:

$$\frac{R_i - R_f}{\beta_i}$$

Where R_i= the expected return on stock *i*; R_f= the return on a riskless asset and β_i = the expected change in the rate of return on stock *i* associated with a 1% change in the market return.

Ranking of the stocks (from highest to lowest) is done on the basis of their excess return to beta ratio. This ranking represents the desirability of any stock's inclusion in a portfolio. The selection of the stocks depends on a unique cut-off rate such that all stocks with higher ratios of $(R_i - R_f)/\beta_i$ are included and all stocks with lower ratios are excluded. This cut-off point is denoted by C*. The highest C_i value is taken as the cut-off point C*.

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^{n} \frac{(R_i - R_f)\beta_i}{\sigma_{ei}^2}}{1 + \sigma_m^2 \sum_{i=1}^{n} \left(\frac{\beta_i^2}{\sigma_{ei}^2}\right)}$$

Where σ_m^2= the variance in the market index and σ_{ei}^2= the variance of a stock's movement that is not associated with the movement of the market index. This is usually referred to as a stock's unsystematic risk.

After determining the securities to be selected, the investor should find out how much should be invested in each security. The percentage invested in each security is

$$X_i = \frac{Z_i}{\sum_{i=1}^{n} Z_i}$$

Where

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2}\left(\frac{R_i - R_f}{\beta_i}\right) - C^*$$

The first expression indicates the weights on each security and they sum up to one. The second expression determines the relative investment in each security. The residual variance on each security σ_{ei}^2 plays an important role in determining the amount to be invested in each security.

After determining the weights on each security, beta and alpha on a portfolio are calculated in order to find out the portfolio return and risk. Beta on a portfolio β_p as a

weighted average of the individual β_i on each stock in the portfolio where the weights are the fraction of the portfolio invested in each stock. Then

$$\beta_p = \sum_{i=1}^{n} X_i \beta_i$$

Similarly define the Alpha on the portfolio α_p as

$$\propto_p = \sum_{i=1}^{n} X_i \propto_i$$

The return on investor's portfolio can be represented as

$$R_p = \propto_p + \beta_p R_m$$

And the risk of the investor's portfolio σ_p as

$$\sigma_p = \sqrt{\beta_p^2 \sigma_m^2 + \sum_{i=1}^{n} X_i^2 \sigma_{ei}^2}$$

4. Data Analysis and Findings

Firstly the securities are ranked according to their excess return to beta ratio from highest to lowest. Among 164 companies 23 companies offer less return then risk free rate. And then C_i is calculated in order to find out the optimum C_i. The highest C_i value is considered as the optimum C_i. And this is known as the cut-off point C*.

Table 2: Result of Optimal Portfolio from Selected Companies (July 2007 to June 2012)

Security Name	$(R_i - R_f)/\beta_i$	$[(R_i - R_f)*\beta_i]/\sigma^2_{ei}$	$\sum[[(R_i - R_f)*\beta_i]/\sigma^2_{ei}]$	β_i^2/σ^2_{ei}	$\sum(\beta_i^2/\sigma^2_{ei})$	C_i
Meghna Pet Industries	0.1214	0.2338	0.2338	1.9259	1.9259	0.0022
Fine Foods Limited	0.1205	0.6594	0.8932	5.4733	7.3993	0.0081
Bata Shoe	0.1048	0.8938	1.7870	8.5323	15.9316	0.0150
Beach Hatchery Ltd.	0.1025	0.5653	2.3523	5.5169	21.4485	0.0189
Bd.Thai Aluminium	0.0855	0.2508	2.6031	2.9326	24.3811	0.0204
Al-Haj Textile	0.0815	0.1896	2.7927	2.3263	26.7074	0.0215
Pharma Aids	0.0790	0.3603	3.1530	4.5599	31.2673	0.0235
Kohinoor Chemicals	0.0782	0.0631	3.2161	0.8067	32.0740	0.0238
Aftab Automobiles	0.0776	0.3160	3.5322	4.0738	36.1477	0.0254
BATBC	0.0751	1.0056	4.5377	13.3970	49.5448	0.0297
Lankabangla Finance Ltd.	0.0689	0.4906	5.0283	7.1193	56.6641	0.0315
Janata Insurance	0.0686	0.5834	5.6117	8.5073	65.1714	0.0334
Bd. Welding Electrodes	0.0684	0.6549	6.2666	9.5821	74.7535	0.0352
Purabi Gen. Insurance	0.0668	0.5532	6.8198	8.2825	83.0360	0.0367
IDLC	0.0587	0.2926	7.1125	4.9879	88.0239	0.0372
Hakkani Pulp & Paper	0.0577	0.4325	7.5449	7.4942	95.5181	0.0380
United Insurance	0.0576	0.2227	7.7677	3.8686	99.3866	0.0384
CMC Kamal	0.0572	0.6889	8.4566	12.0493	111.4360	0.0394
BEXIMCO	0.0557	0.5676	9.0241	10.1821	121.6181	0.0402
Olympic Industries	0.0542	0.8677	9.8918	16.0001	137.6182	0.0411
Savar Refractories	0.0534	0.2565	10.1483	4.8050	142.4232	0.0413
Karnaphuli Insurance	0.0530	0.3965	10.5447	7.4860	149.9092	0.0417
Prime Finance & Invest.	0.0527	0.2944	10.8391	5.5805	155.4897	0.0419
Rahim Textile	0.0523	0.3848	11.2239	7.3533	162.8430	0.0422
Legacy Footwear	0.0520	0.8010	12.0249	15.4111	178.2541	0.0427
Stylecraft	0.0508	0.2141	12.2390	4.2169	182.4710	0.0429
Ambee Pharma	0.0489	0.6488	12.8878	13.2681	195.7391	0.0431
Kay & Que	0.0481	0.2002	13.0881	4.1604	199.8996	0.0432
Padma Oil Co.	0.0447	0.7619	13.8500	17.0465	216.9461	0.0433
Dutch-Bangla Bank	0.0445	0.2395	14.0894	5.3769	222.3230	0.0433
Beximco Synthetics	0.0442	0.1979	14.2873	4.4787	226.8017	0.0433
Green Delta Insurance	0.0442	0.2222	14.5095	5.0298	231.8315	0.0433
National Tea Co. Ltd.	0.0437	0.2874	14.7970	6.5808	238.4123	0.0433*

From the table 2 it can be seen that among 235 companies the optimum portfolio consists of investing in 33 companies for which $(R_i - R_f) /\beta_i$ is greater than a particular cut off point C*. Here, the cut-off rate is 0.0433.

Table 3: Result of Weights amount invested in Portfolio from Selected Companies (July 2007 to June 2012)

No.	Name of Company	Weight of Securities (%)	Mean Return	Beta
1	Bata Shoe	15.91%	6.00%	0.4828
2	BATBC	12.67%	4.63%	0.4916
3	Fine Foods Limited	10.38%	8.12%	0.5959
4	Meghna Pet Industries	7.55%	4.48%	0.2918
5	Beach Hatchery Ltd.	5.15%	10.46%	0.9293
6	Lankabangla Finance Ltd.	5.10%	4.54%	0.5228
7	Aftab Automobiles	3.60%	5.34%	0.5675
8	Bd.Thai Aluminium	3.30%	5.64%	0.5501
9	Olympic Industries	3.13%	5.36%	0.8162
10	Bd. Welding Electrodes	2.90%	9.23%	1.2134
11	Janata Insurance	2.71%	8.91%	1.1629
12	Hakkani Pulp & Paper	2.46%	4.65%	0.6428
13	Purabi Gen. Insurance	2.41%	8.82%	1.1802
14	Legacy Footwear	2.33%	5.28%	0.8362
15	BEXIMCO	2.20%	5.64%	0.8432
16	CMC Kamal	1.99%	7.95%	1.2257
17	Kohinoor Chemicals	1.83%	2.70%	0.2250
18	IDLC	1.78%	4.63%	0.6300
19	Pharma Aids	1.77%	11.60%	1.3496
20	Karnaphuli Insurance	1.46%	4.76%	0.7215
21	Al-Haj Textile	1.29%	9.18%	1.0114
22	United Insurance	1.27%	4.60%	0.6369
23	Rahim Textile	1.25%	4.99%	0.7737
24	Prime Finance & Invest.	1.19%	4.36%	0.6480
25	Savar Refractories	1.09%	4.39%	0.6473
26	Ambee Pharma	1.07%	5.87%	1.0079
27	Stylecraft	1.02%	3.22%	0.4505
28	Kay & Que	0.54%	3.54%	0.5416
29	Padma Oil Co.	0.28%	6.35%	1.2112
30	Green Delta Insurance	0.12%	3.31%	0.5376
31	Beximco Synthetics	0.10%	3.36%	0.5471
32	Dutch-Bangla Bank	0.08%	6.16%	1.1724
33	National Tea Company Limited	0.07%	3.12%	0.4991
Beta on a Portfolio, β_p			**0.6545**	
Alpha on a Portfolio, α_p			**0.0531**	
Portfolio Return			**6.17%**	
Portfolio Risk			**8.76%**	

Table 2 and 3 clearly explain the results of empirical analysis. Only those securities are desirable in the portfolio, which have positive excess return over risk free return. If short sale is not allowed, it is seen that the optimum portfolio consists of only 33 securities with the largest investment in Bata Shoe Company (Bangladesh) Ltd. And the smallest in National Tea Company Limited. Portfolio return and portfolio risk have found out respectively 6.17% and 8.76%. The result shows that portfolio beta is significantly lower than the market beta and portfolio return is much higher than the

portfolio variance. The results are almost similar to the earlier results (e.g. Paudel and Koirala, 2006; Singh, 2007; Kumar, 2011; and Elton et al., 1976). All the securities which have excess return to beta ratio more than the cut-off point are included in the portfolio. Such portfolio is the optimum portfolio and the securities included in the portfolio are the efficient securities.

The study that follows 164 stocks needs 494 numbers of inputs as against 13694 for Markowitz Model. So, it can be stated that implementation of Markowitz model is much more time-consuming and more complex by the number of estimates required. And the framework of Sharpe's single index model for optimal portfolio construction is very simple and useful. The results are almost similar to the earlier results (e.g. Meenakshi and Sarita, 2012).

5. Conclusion

Risk and return play an important role in making any investment decisions. This study aims at analyzing the opportunity that are available for investors as per as returns are concerned and the investment of risk thereof while investing in equity of firms listed in the Dhaka stock exchange. Sharpe's single-index model was applied by using the monthly closing prices of 164 companies listed in DSE and DSE all share price index for the period from July 2007 to June 2012. From the empirical analysis, it can be said that data coverage of this paper is moreover satisfactory to make an investment decision because it covers 69.79% of data. Out of 164 companies taken for the study, 7 companies are showing negative returns and the other 157 companies are showing positive returns. Out of 164 companies, 61 companies where market beta is above 1, show that the investments in these stocks are outperforming than the market. The study shows that portfolio beta is significantly lower than the market beta and portfolio return is much higher than the portfolio variance. And the framework of Sharpe's single index model for optimal portfolio construction is very simple and useful. The results are almost similar to the earlier results (e.g. Paudel and Koirala, 2006; Singh, 2007; Kumar, 2011; Elton et al., 1976; and Meenakshi and Sarita, 2012). From this empirical analysis, to some extent one can able to forecast individual security’s return through the market movement and can make use of it.

5.1 Limitations of the Research

This paper attempts to construct an optimal portfolio by using Sharpe's single-index model and thereby helps to make investment decisions. The current study however has some limitations. This study did not take into consideration the companies that are not listed on the DSE and the companies that are listed and traded but stopped operations. This study used monthly data rather than daily data. This study has successfully constructed an optimal portfolio consisting of 33 securities among various sectors; future research may concentrate on portfolio selection models and the development of new portfolio selection models and policies.

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