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Testing the Relationship between Portfolio Size and Portfolio Risk

Dr. Seema Shokeen
Assistant Professor
Department of Business Administration
Maharaja Surajmal Institute, New Delhi

Email ID : seemashokeen@msi-ggsip.org

ABSTRACT

The present study examined the relationship between portfolio size and portfolio risk. For the purpose of examining the relationship between portfolio size and portfolio risk, the present study used daily adjusted closing prices of listed 225 securities of BSE-500. BSE-Sensitive Index has been used as market index. The present study is for eleven years starting from 1 April, 2005 to 31 March, 2016 due to the transition economy. The study is based on the secondary data and the data related for this study has been collected from the Centre for Monitoring of Indian Economy (CMIE) prowess database software. The results produce interested finding which are also consistent with the previous studies. The results of the current study showed negative relationship exists between portfolio size and portfolio risk. The present research will be valuable for interested parties, investors, researchers that contribute towards the perceptive of the Indian stock market.

KEYWORDS:

Bombay Stock Exchange (BSE), Diversification-Effect, Portfolio risk.

INTRODUCTION

The risk of a stock portfolio depends on the proportion of the individual stocks, their variances and their covariance's. A change in any of these variables will change the risk of the portfolio. Still it is generally true when stocks are randomly selected and combined in equal proportions into a portfolio, the risk of portfolio declines as the number of different stocks in it increases (Statman, 1987). Risk inherent in an investment are often described as being made up of those risks which are common to all assets, and thus cannot be diversified (market risk) and those which are unique to

the asset, and can thus be eliminated by diversification(firm-specific risk).

As portfolio size increase, so the risk of the portfolio falls. Of importance to investors is the number of assets in portfolio beyond which addition of further assets will not result in further reduction in risk. Modern portfolio theory (MPT) proposes how rational investors will use diversification to optimize their portfolios, and how risky asset should be priced. Markowitz (1952) showed that the variance of the return in a portfolio of financial securities depends not only on the riskiness of individual securities in the portfolio, but also on the relationship of risk among these securities. This suggests that as more assets classes added to the portfolio, the more portfolio risk reduced (Al Suqaier and Al Ziyud, 2011). Harry Markowitz, known as the father of modern portfolio theory, who founded the portfolio selection model. He was the first to develop the concept of portfolio diversification and showed that how portfolio diversification works to reduce the risk of a portfolio to an investor. The selection of a portfolio is a major issue and the modern portfolio theory argues that the investment risk can be reduced significantly by clubbing a number of assets.

REVIEW OF LITERATURE

Evans and Archer (1968) estimated the relationship between diversification and the level of variations of portfolio returns. The study used 470 of the securities listed on Standard and Poor's Index. The results of the study suggested that a somewhat stable and predictable relationship does indeed exist between the number of securities included in a portfolio and portfolio dispersion. The study also explained that for the purpose of concluding portfolio according to their methodology, there is a need to perform on marginal analysis.

Wagner and Lau (1971) conducted a study on the effect of diversification on risk and in their study showed that the rate of return on well diversified low risk portfolios indeeded significantly lower than the return on well diversified higher risk portfolios. The study suggested that the investment performance can often be improved by expanding the list of qualified securities to include higher return, higher risk stocks, while offsetting the increase in market risk through more effective diversification.

Elton and Gruber (1977) presented the formula for determining the effect of diversification on risk and showed that

estimating expected variance and total risk seems to be very good but much cruder in estimating variance in variance.

Statman (1987) conducted a study on how many stocks make a diversified portfolio. The study showed that for borrowing investors, a well diversified portfolio must include 30 stocks and for lending investors there must be at least 40 stocks. The conclusion of this study was the extensively accepted idea that the benefits of diversification are practically exhausted when the number of stocks reaches 10 to 15.

Woerheide and Persson (1993) studied whether a diversification index could measure the degree of diversification of an unevenly distributed portfolio and what index value represents a reasonably diversified portfolio. The study concluded that index values of less than 0.85 implied that a portfolio was possibly not adequately diversified. It revealed that portfolios with index values greater than 0.91 were maybe adequately diversified. The study also indicated that the index could be used to define an evenly distributed portfolio equivalency.

Goetzmann and Kumar (2008) examined the diversification choices of individual investors during a six-year period in the U.S. capital market history. The present study used a data from U.S. discount brokerage house and found that the sample was under-diversified.

Al Suqaier and Al Ziyud (2011) examined the effect of diversification as Amman Stock Exchange during the study period of 2/12/2005 to 13/3/2010. In the study, for the purpose of testing the hypothesis, a sample of 100 companies was used. The results of the study revealed that diversification increase with a decrease rate.

Another study conducted by **Gupta and Khoon (2001)** examined the relationship between the portfolio risk and the number of stocks in a portfolio in the period of September 1988 to June 1997 to determine the optimum size of portfolio of stocks. In the study a sample of 213 stocks traded on Kuala Lumpur Stock Exchange (KLSE) were used. The results of the study revealed that the diversification benefits are available upto the 27 securities.

On the other hand **Alekneviciene et al. (2012)** in their study measured the effect of diversification on differently-weighted stocks during the study period of 2009 to

2010 on the basis of daily stock prices in the Lithuanian Stock Exchange. The research results showed that forming naive portfolios, the diversification effect is a little larger than forming differently-weighted portfolios by capitalization. The study showed that forming differently-weighted portfolios by capitalization from 22 stocks, 97 % of diversifiable risk can be eliminated. The study showed that the main reason of both differences is due to the consistence of smaller number of stocks.

RESEARCH QUESTION

- Is there a relationship between portfolio size and portfolio risk?

RESEARCH OBJECTIVE

- To examine the relationship between portfolio size and portfolio risk.

RESEARCH HYPOTHESIS

To examine the relationship between portfolio size and portfolio risk, the following hypothesis has been tested against the alternative hypothesis:

Null Hypothesis (H0): There is a positive relationship between portfolio size and portfolio risk.

Alternative Hypothesis (H1): There is a negative relationship between portfolio size and portfolio risk.

RESEARCH METHODOLOGY

To examine the relationship between portfolio size and portfolio risk, a sample of 225 securities listed on BSE-500 has been used. The study is based on the secondary data and the data relevant for this study has been collected from the Centre for Monitoring of Indian Economy (CMIE) prowess database software. The present study is for eleven years starting from 1 April, 2005 to 31 March 2016. This period is relevant because it represents transition economy. The selection of securities varies on the basis of market capitalization, trading volume and the availability of data. The BSE Sensex is taken as the market proxy. Normality of data has been checked through the Jarque-Bera Statistics. The present study also tested hypothesized relationship between portfolio size and portfolio risk by using the regression equation.

Daily return of securities has been calculated by applying the following formula:

$$HoldingPeriod\ \mathrm{Re}turn(R_{it}) = l_n(\frac{P_t}{P_{t-1}})*100$$

Where R_{it} is return on security i in time period t, P_t is the security price at the time t, P_{t-1} is the security price at the time period t-1.

The average return of securities is calculated as:

$$\overline{R}_i = \sum_{t=1}^{N} R_{it}$$

And the average return of market has been computed as:

$$\overline{R}_m = \sum_{t=1}^{N} R_{mt}$$

PORTFOLIO RETURN: It is the weighted average of the estimated return for each security in the portfolio. Portfolio return has been calculated by using this formula:

$$\overline{R}_P = \sum_{i=1}^{N} W_i \overline{R}_i$$

Where $\overline{R}_P$ is the portfolio return and W_i is the weight give to security i.

PORTFOLIO STANDARD DEVIATION: Symbolically, portfolio standard deviation can be obtained as:

$$\sigma_P = \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \ \mathrm{cov}(R_i, R_j)}$$

Where $Cov(R_i R_j)$ is the covariance between the rate of return of the *i* and the *j* security.

RELATIONSHIP BETWEEN PORTFOLIO SIZE AND PORTFOLIO RISK: The following regression equation are estimated to test the relationship between portfolio size and portfolio risk as suggested by Al Suqaier and Al Ziyud (2011)

$$Y_i = \beta_i(\frac{1}{X_i}) + A$$

Where, X_i is the size of portfolio i

β_i is the parameter of the model

Y_i Computed mean portfolio standard deviation.

A is constant

FINDINGS

RESULTS OF PORTFOLIO SIZE AND PORTFOLIO RISK (EFFECT OF DIVERSIFICATION)

Table 1 presents the result of the relationship between portfolio size and the portfolio risk. In the study normality has been checked with the help of Jarque-Bera Statistics and from the Jarque-Bera statistics found, data follow the normal distribution. Using data for 225 securities over the period of 2005-2016, showed that as more and more securities increase in the portfolio, the securities risk declines. In the current study to examine the relationship between portfolio size and risk, securities are randomly selected assuming equally weighted portfolios. The results of the diversification effect have been measured by using the Markowitz model. Table (1) shows that as the number of securities in portfolio increases, the portfolios risk as measured by the standard deviation decreases, which indicates the existence of a negative relationship between portfolio size and portfolio risk.

TABLE 1: **PORTFOLIO SIZE AND PORTFOLIO RISK (EFFECT OF DIVERSIFICATION)**

No. of Securities in Portfolios	Portfolios Standard Deviation (Portfolios Risk)
1	16.28
2	14.25
3	13.35
4	12.81
5	12.45
10	11.45
15	10.95
25	10.45
35	10.17
50	9.91
70	9.62
90	9.39
110	9.19
130	9

150	8.83
170	8.67
225	8.27

Source: Compiled and calculated by the author

TESTING THE RELATIONSHIP BETWEEN PORTFOLIO SIZE AND PORTFOLIO RISK

The present study also tested the hypothesized relationship between portfolio size and portfolio risk and it is noticed that our results are significant that means we reject the null hypothesis. The results showed that there is a negative relationship between portfolio size and portfolio risk. It revealed from the table 2 that the value of beta is (-0.04) indicated inverse relationship exists between portfolio size and portfolio risk and the coefficients are also significant at 1 percent level of significance. The results of the present study supported the theoretical concept of diversification.

TABLE 2: REGRESSION MODEL RESULTS

Model	R^2	A	β	**F sig.**
$Y_i = \beta_i(\frac{1}{X_i}) + A$	0.62	7.29 (0.00)*	-0.04 (0.00)*	0.00

Figures in brackets represent the p-values

***denotes significant at 1 percent level of significance**

Source: Compiled and calculated by the author

CONCLUSION

The present study has investigated the relationship between portfolio size and portfolio risk. It is noticed from the current study that as more and more securities increase in the portfolio, the portfolios risk declines. It found that the value of beta is (-0.04) that indicated inverse relationship between portfolio size and portfolio risk and the coefficients are also significant at 1 percent level of significance. The results of the present study supported the theoretical concept of diversification. Overall, this evidence seems to be consistent with other

researches like Elton and Gruber (1977) and Wagner and Lau (1971).

The further study may be attempted to focus on other stock exchanges. Moreover, further research could be made to analyzed the risk and return of different securities on the basis of daily, weekly, monthly, quarterly, half yearly data, yearly data and can check that the relationship between portfolio size and portfolio risk in other countries. There is a need to carry out more research regarding this study.

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