A STUDY OF RISK MANAGEMENT THROUGH DIVERSIFICATION DURING UNCERTAIN MARKET CONDITIONS

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Abstract

This study would conduct a portfolio management analysis of a portfolio formed by six publicly listed companies in the India. The paper is an attempt to demonstrate if efficient diversification is possible during hard time by exercising the Markowitz model. The paper focuses at the existence of portfolio risk management for the Indian Financial Market. The research methodology centers on applying Modern Portfolio Theory, with main emphasis on the Markowitz Efficient Frontier, Risk and Return and Portfolio Optimization. The data is essentially based on the top performing sectors of the Indian economy, and 6 companies are chosen from each sector to test for diversification. Key findings suggest that the risk of the portfolio is lower than the weighted risk of the stocks, i.e. efficient diversification can be achieved.

Key words: *Efficient diversification, portfolio optimization, Portfolio risk and return, t test.*

INTRODUCTION

With the growing integrated global economy and the boom of financial markets world over, it has become imperative for the rapidly growing investor base to understand the fine nuances of the stock market, securities that are traded and factors that affect returns on those securities. In the simplest terms, stock market is a place where buyers and sellers of securities (equity and debt) meet in order to negotiate and carry out selling and purchase transactions. The players of the market may be either handle their own accounts or hire agents for the same. Stock exchanges also assist in the issue and redemption of securities, bonds and other financial instruments as well as the payment of income and dividends. Every stock market has a Market Index. This index is a measure of performance of the companies that are listed on the exchange. An aggregate value produced by combining several stocks or other investment vehicles together and expressing their total values against a base value from a specific date. Major stock exchanges are the Amsterdam Stock

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Exchange, London Stock Exchange, New York Stock Exchange, Paris Bourse, and the Deutsche Börse (Frankfurt Stock Exchange) and Toronto Stock Exchange, Shanghai Stock Exchange and Bombay Stock Exchange Since its inception five decades ago, many studies have been carried out on modern portfolio theory and that diversification across various regions and markets can lower the risk of an investment basket for a given return. Diversification, be it international, sectorial or industry based diversification, has been the backbone of a plethora of investment studies and rationales. A very essential risk management technique, diversification is often confused with the term risk management itself. However, with the relatively recent advent of globalization and integration of world economies, the limitations of diversification and its ineffectiveness in reducing risk in highly correlated and uncertain environments cannot be ignored. Various studies have shown that the benefits of international diversification across both developed and emerging markets have decreased because of a gradual increase in the average correlation of these markets. Thus, if international markets are well integrated, there is no benefit in diversifying across them. Diversification is ill-suited for loss control in severe market downturns.

This thesis is an extensive and detailed study of diversification- it's benefits and limitations. It helps in better understanding of risk management in today's ever changing global economic environment. It also strives to ascertain several alternative diversification options in investing such as investments in gold, real estate, etc.

LITERATURE REVIEW

Diversification has been the most integral technique used for risk management across the world. Market turbulence in any developed economy impacts several regions of the world decreasing the benefits of diversification. *Paliwal Udai (2013)* paper studied risk in the Namibian market and the use of Gold, bonds, Real estate in a portfolio to manage returns during uncertain times. *Westerfield Randolph,* is of opinion Modern capital theory segregates the causes of variability in returns of investments into two elements- Systematic and Unsystematic. Systematic variability is the variability in returns of portfolio attributable to the variability in the market returns as a whole. Unsystematic variability is not related to the variability of the market; it is the individual internal risk of any organization which can be diversified unlike the systematic risk. This paper states with the help of historical examples how increasing the number of stocks in your portfolio effectively decreases the systematic risk by 80-90%. *Stevenson and Jennings(1987)* stated that The results of this study indicate that a portfolio of approximately eight to sixteen randomly selected stocks will closely resemble the market portfolio in terms of fluctuations in the rate of return. Other studies have shown similar results and an unusual consistency using different time periods, different groups of stocks and different techniques. Consequently while the CAPM model requires the purchase of the market portfolio, essentially the same result can be achieved from a practical

standpoint with a much smaller portfolio. *Ikhlaas Gurrib and Saad Alshahrani (2012)* Said that The paper looks at the existence of portfolio risk management for the UAE Financial Market. The research methodology centers on applying Modern Portfolio Theory, with particular emphasis on the Markowitz Efficient Frontier, Minimum Variance Analysis, and Portfolio Optimization. The data is essentially based on the top performing sectors of the UAE economy, and twenty key companies are chosen from each sector to test for diversification. Key findings suggest that the risk of the portfolio is lower than the weighted risk of the twenty individual stocks, i.e. efficient diversification can be achieved. *Robert M. Tamiso & Roy S. Freedman (1995) has* written from the perspective of a financial advisor, addresses the benefits and pitfalls of utilizing new innovative approaches to confront risk in a portfolio in uncertain times by incorporating futures and real assets. It shows how traditional time-value and diversification techniques can sometimes fail, and then discuss how the newer approaches can be used. They also discuss the place of real assets within an overall strategy for institutional risk management. According to *Baird, Private wealth management research (2010)* A proper asset allocation plan provides a long-term framework to structure a portfolio. Yet, in some environments value can be added by taking a more active approach to portfolio construction. In the face of today's economic uncertainties, this paper discusses that a dynamic asset allocation plan could benefit many investors. A dynamic asset allocation, as opposed to a static asset allocation plan broadens the investment universe to include options that seek to capitalize on market opportunities, avoid major pitfalls, or reduce portfolio volatility. They consider there to be three major components of a dynamic asset allocation plan: traditional asset allocation, alternative diversification, and flexible strategies. White and Irwin (1972), using aggregate U.S. Census data, compared diversification across farm size classes. The authors concluded that larger farms are more specialized. Pope and Prescott (1980), using 1,000 California crop farms and four different 5 measures of diversification investigated the relationship between diversification and farm size and other socio-economic variables. The authors found a strong indication of a positive relationship between diversification and farm size. In analyzing data on 2,192 farms across three U.S. regions, Sun, Jinkins, and El-Osta (1995) distinguished between different ìstages of diversification which were found to influence the relationship between size and diversification.

RESEARCH METHODOLOGY

Purpose of Study

Diversification is an extremely useful tool for risk reduction in portfolios. So much so, the term is sometimes erroneously considered synonymous to risk management. All knowledgeable investors believe in diversifying their basket of securities in order to generate the maximum return and by bearing the minimum risk possible. Today, however, with the widespread globalization and integration of economies the effect of diversification reduces during bad economic times as the economy of

all nations get hit simultaneously. Diversification is ill-suited for loss control in severe market downturns. This study aims at proving this above statement. It also strives to ascertain several alternative investments during uncertain times when investing in equity is not viable such as investing in gold, real estate, etc.

Objectives

The Main objectives of the study are-

1. To analyze and understand the Risk-Return Linear relationship.
2. To understand diversification in portfolios and the reduction in risk associated with it subsequently.
3. To understand and find out security returns with high risk during bad market conditions during stable economic conditions.
4. To analyze and understand the importance of diversifying among different asset classes during uncertain times.

Sources of Data and Data Collection

In order to form the minimum risk portfolio, 6 companies whose stocks trade in the Bombay Stock Exchange, were chosen. With the intension of forming an optimal diversified portfolio, the stocks were selected from three diverse and prominent industries of the Indian economy, i.e., Banking, Telecommunication and Infrastructure and Construction. These six companies were:

A.   Banking
1) Housing Development Finance Corporation(HDFC)
2) Industrial Credit and Investment Corporation of India

B.   Telecommunication
1) Bharti Airtel
2) Reliance communications

C.   Infrastructure and Construction
1) Larsen and Toubro
2) Jaiprakash Associates

Historical stock prices of the required companies were extracted from the money control website. The Sensex historical returns required to calculate the market return were extracted from the Bombay Stock Exchange website. The 91 day T-bill rates for the years in question used to calculate the Risk Free Rate of return, were extracted from the Reserve Bank of India website

The research design used in this study is exploratory as well as causal in nature. Exploratory Research: Secondary data was collected and analyzed for the purpose of calculating and studying the pre-crisis and post-crisis portfolio returns. This analysis led to the conclusion that the post-crisis returns were significantly lower than the pre-crisis returns. Exploratory research results helped us formulate the main hypothesis of our study. Causal Research: A hypothesis was framed to test whether or not there is a significant difference in portfolio return through diversification in uncertain times. This hypothesis was tested using the t-test of probability distribution. For the pre-crisis period the monthly returns of the companies over a period of one year (2006-2007) are used to compute their log returns. These log returns of the 6 companies are used to calculate their mean ACTUAL return, their VARIANCE and STANDARD DEVIATION. Of the 6 companies in question, we shortlisted just 3 companies, the ones which have generated the least variances (risk). The three companies which generated the least variance were:

- HDFC
- BHARTI AIRTEL
- LARSEN & TOUBRO

Hypothesis Framed

In order to test the impact of the financial crisis on the constructed portfolios, we tested the portfolio returns by using the t-test of probability distribution. The level of significance used was 5%. And the test was one tailed. This too was achieved using the help of Microsoft Excel. The hypothesis formed was:

- Ho: there is no significant difference in portfolio return through diversification in uncertain times
- Ha: there is significant difference in portfolio return through diversification in uncertain times.

Calculation of expected return

We have generated the actual historical returns. However, in order to form the optimum minimum variance portfolio using these three weights, I need the expected return of all three stocks. This is achieved by using the CAPM (Capital Asset Pricing Model)

$E(R) = Rm + (Rm-Rf)b$

Where,

Rm = Market/ Sensex return over the year 2006-07

Rf = Risk free return that the government issued treasury bills generated over 2006-07

β = Sensitivity of the individual stock return to the market return.

The historical Sensex returns used were extracted from the BSE website. The 91 day Treasury bill yields were extracted from the central bank (Reserve Bank of India's) website.

Beta is calculated using the formula

β = Covariance (market log returns, stock log returns)/variance (market log returns)

Next, in order to generate the optimum portfolio, I assigned 3 combinations of weights to these three stocks and chose the combination which generated the maximum portfolio return. Further the covariance matrix of these three stocks has been calculated For the post crisis period (2009-2010) also the same methodology was used to generate the optimum portfolio return and risk.

Measuring Risk

The most common measures of calculating risk are standard deviation of the historical returns or average returns of a specific investment. A high standard deviation indicates a high degree of risk.

Standard deviation:

$$\sigma = \sqrt{E[(X-\mu)^2]}$$
$$= \sqrt{E[X^2] + E[(-2\mu X)] + E[\mu^2]} = \sqrt{E[X^2] - 2\mu\,E[X] + \mu^2}$$
$$= \sqrt{E[X^2] - 2\mu^2 + \mu^2} = \sqrt{E[X^2] - \mu^2}$$
$$= \sqrt{E[X^2] - (E[X])^2}.$$

Where,

X = random variable

E(X) = expected value of X

μ = mean value of X

Diversification and its importance in Portfolio building

The term portfolio refers to any collection of financial assets such as stocks, bonds, and cash. Portfolios may be held by individual investors and/or managed by financial professionals, hedge funds, banks and other financial institutions. It is a generally accepted principle that a portfolio is designed according to the investor's risk tolerance, time frame and investment objectives. For any well managed portfolio, one of the most basic considerations to be kept in mind is the concept of Diversification. Studies have shown that maintaining a well-diversified portfolio of 25 to 30 stocks will yield

the most cost-effective level of risk reduction. Investing in more securities will still yield further diversification benefits, albeit at a drastically smaller rate. Hence, diversification is an essential part of portfolio building. A well-diversified portfolio is one in which the constituent stocks are negatively correlated. This is because if all the securities included in a portfolio are positively correlated to each other's price movements and hence move in the same direction, then, when the market faces financial depression, all the securities would simultaneously underperform. This would by default lead to the formation of a highly risky portfolio.

DATA OUTPUT AND ANALYSIS

Table 1
Pre-Crisis Portfolio Construction

	Expected return	Weights (1)	Weighted Return	Weights (2)	Weighted return	Weights (3)	Weighted Return
HDFC	17.49	60%	10.494	20%	3.498	33%	5.771
AIRTEL	14.74	20%	2.948	60%	8.884	33%	4.864
L&T	16.45	20%	3.29	20%	3.29	34%	5.593
E(r)			**16.73**		15.63		16.22

Three portfolios were constructed for the following stocks:
- HDFC
- BHARTI AIRTEL
- LARSEN AND TOUBRO, using different combinations of weights.

In the first portfolio (portfolio A) the following weights were used for the above stocks: 60%, 20%, 20%. By using the weighted average method, expected return for portfolio A was 16.732% Similarly, for portfolio B and C the weighted average returns were 15.63 and 16.22 respectively. The first portfolio which gave HDFC the highest weight generated the maximum portfolio return and was used as the optimum portfolio to calculate the risk.

Table 2
Post-Crisis Portfolio Return

	Expected return	Weights (1)	Weighted Return	Weights (2)	Weighted return	Weights (3)	Weighted Return
HDFC	4.823	20%	0.964	60%	2.893	33%	1.591
AIRTEL	4.917	20%	0.983	20%	0.983	33%	1.622
L&T	5.212	60%	3.127	20%	1.042	34%	1.77
E(r)			5.07		4.92		4.98

The same three minimum variance stocks were used to construct three different weight portfolios for the post-crisis period (2009-10). In the first portfolio (portfolio A) the following weights were used for the above stocks: 20%, 20%, and 60%. By

using the weighted average method, expected return for portfolio A was 5.07% similarly, for portfolio B and C the weighted average returns were 4.92% and 4.98% respectively. The first portfolio which gave L&T the highest weight generated the maximum portfolio return and was used as the optimum portfolio to calculate the risk. The above two tables show how all three diversified portfolios were affected badly due the crisis. They generated much higher returns in 2006-07 than in 2009-10.

Table 3
Impact of crisis on the chosen portfolio's risk and return

	Pre-Crisis	*Post-Crisis*
	weighted return	*weighted return*
HDFC	10.494	0.96466
AIRTEL	2.948	0.98354
LARSEN AND TOUBRO	3.29	3.12762
	16.732	5.07582
Portfolio risk	0.861184	0.69144054

The same diversified portfolio comprising of similar stocks was used for both pre and post crisis analysis. As seen the same portfolio generated much higher returns in 2006-07 than in 2009-10. Also the risk associated with the portfolio was higher in the pre-crisis period corresponding to the higher return; however the risk of the portfolio in the post-crisis period was only a tad bit lower than the pre-crisis risk. The fall in risk due to lower expected return is not in tandem with the degree of fall in expected return.

Table 4
Hypothesis t-test

	2006-07	*2009-10*
portfolio 1	16.732	5.07582
portfolio2	15.632	4.92006
portfolio 3	16.2289	4.986848
p value	0.00032515	

On performing the t-test on the pre and post crisis returns, we obtained a p value of 0.000325. This is lesser than the 0.05 level of significance. Hence, we reject the null hypothesis. We thus prove through our hypothesis testing that there is significant difference in portfolio return through diversification in uncertain times.

LIMITATIONS OF THE STUDY

• The sample size (n) used for this study is very small. It was not possible to take a large number of stocks as the calculation of portfolio variance becomes extremely difficult and tedious for the same.

- The data used for the analysis is purely historical in nature. Though the sources of data collection are authentic, the possibility of some manipulation cannot be ruled out.

CONCLUSION

Through and through we have talked about optimum portfolio building through diversification which would generate a minimum variance and maximum expected return. This study aims to show how diversification, a very basic, helpful and widely acclaimed tool of portfolio building, can falter to an extent during uncertain economic/ market conditions. My report shows this through the analysis of three stocks' data pre and post crisis. By testing the portfolio returns, this study has conclusive evidence that

- There is a significant difference between the diversified portfolio return in 2006-07(pre-crisis period) and in 2009-10 (post-crisis) period.

- This diluted effect of diversification could be for a variety of reasons; the primary being that bad economic conditions can cause a lot of stocks of varied industries to falter simultaneously.

There are many studies dedicated to this dilemma and many of them suggest the various other alternative options that investors should keep in mind while investing during bad economic times. During an economic downturn, the investors should play safe and invest cautiously and intelligently. They should keep in mind the following:

- Equity becomes the riskiest of all assets during a crisis.

- Investing in secured funds and in Bonds, Fixed Deposits, etc. which will give them a sure shot return.

- Investors should look at investing in alternative options such as futures, mutual funds, real assets like land, etc. rather than sticking to the traditional investment stocks.

- A dynamic and well diversified asset allocation plan should be made.

References

Books and Journals

Baird (2010), "Asset allocation during uncertain times", September 2010, Private Wealth Management Research, *Private Wealth Management Research*, Sept 2010 , Pg. No. 1-3.

Hsu, H.C. "Global risk diversification: an empirical investigation from the U. S. perspective". *International Business & Economics Research Journal*, Vol. 10, No. 8; 57–65.

Ikhlaas Gurrib and Saad Alshahrani, (2012), "Diversification in Portfolio Risk Management: The Case of the UAE Financial Market", *International Journal of Trade, Economics and Finance*, Vol. 3, No. 6, December 2012.

Pope, R.D. and R. Prescott. (1980), Diversification in Relation to Farm Size and Other Socioeconomic Characteristics, *American Journal of Agricultural Economics*, Vol. 62 (1980): 554-559.

Randolph Westerfield (1975), "How diversification reduces risk: Some empirical evidence, *Journal of Financial and Quantitative Analysis*, Vol. 10 /issue 4 Nov 1975 , Pg No. 561-561.

Stevenson and Jennings (1987), "How many stocks make a diversified portfolio?" *Journal of Financial and Quantitative Analysis*, Vol., 22, Sept 1987, Pg No. 353 -361.

Sun, T. Y., J. E. Jinkins, and H. E. El-Osta (1995), Multinomial Logit Analysis of Farm Diversification for Midwestern Farms. Paper Presented at the AAEA annual meetings, Indianapolis, IN, 1995.

Udai Paliwal (2013), "Diversification in a small market: some evidence from Namibia", *International Journal of Economics and Finance*, May 2013, Vol. 5, Issue 5, p. 184.