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Portfolio Selection using Min-Max Approach; Selected Bank in India: Markowitz Model

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Abstract: As we know that portfolio management means diversification of scrip at last minimize portfolio risk. First part of paper presented research methodology and second part presented the how the portfolio diversification help investors for switching portfolio on basis proportion. For diversification of portfolio researcher followed Markowitz model selected three major private sector banks for analysis of proportion of investment with number of different combination. Researcher found that co efficient of correlation between banks must be positive return with minimize total portfolio risk. Markowitz model also focus on how to set efficient frontier with diversification of portfolio and reached line have positive correlation between scrip's.

Keywords: Markowitz Model, Diversification of Portfolio, Proportion of Investment, co variance, co efficient of correlation, efficient frontier, Expected Return, Portfolio Risk.

I. INTRODUCTION

Bankers play very important role in the economic life of the nation. Banks play an important role in development of Indian economy & financial transparency. The **Reserve Bank of India (RBI)** is the central bank of India and controls the monetary policy. Main function of banking sector is Accepting deposits from public, Lending money to public (Loans), Transferring money from one place to another, Credit Creation, Acting as trustees, Keeping valuables in safe custody, Investment decisions and analysis. As portfolio selection most important part is lending and borrowing rate on total market capitalization.

II. ROLE OF THE PORTFOLIO MANAGEMENT AND SELECTION

A portfolio is usually defined as collection of assets held by an investor. These assets include real as well as financial assets. When an amount is invested in any security, it is expected to be held by the investor for a certain period of time. The investor expects monetary return from such investment which may not guarantee an assured rate of return. It may change depending upon different factors. Investment in such security has risk associated with it.

III. PORTFOLIO DIVERSIFICATION

Diversification is one of techniques for reducing investment risk. It means reducing risk by investing in a variety of assets. Therefore, any risk-averse investor will diversify to at least some extent, with more risk-averse investors diversifying more completely than less risk-averse investors.

IV. MODERN MOTIVATION PORTFOLIO THEORY – MARKOWITZ

Markowitz assists in the selection of the most efficient portfolio by analyzing various possible portfolios of the given securities. By choosing securities that do not 'move' exactly together, this model shows investors how to reduce their risk. This model is based on expected returns (mean) and the standard deviation (variance) of the various portfolios. Markowitz (1952) studied the problem of risk associated with such investment and developed what is popularly known as the theory of investment or portfolio theory.

Markowitz used mathematical programming and statistical analysis in order to arrange for the optimum allocation of assets within portfolio. To reach this objective Markowitz generated portfolio with a reward- risk context. He developed the optimal rule for allocating the available amount in different securities. The concept of diversification was mathematically developed by him (Markowitz, 1991). The optimal portfolio was used in 1952 by Harry Markowitz, and it shows us that it is possible for different portfolios to have varying levels of risk and return. Each investor must decide how much risk they can handle and then allocate (or diversify) their portfolio according to this decision. Portfolio theory deals with the value and risk of portfolios rather than individual securities. It is often called modern portfolio theory or Markowitz portfolio theory which assumes that investors try to minimize risk to get highest return.

In order to use Markowitz approach for N securities, we need to obtain following estimates:

- 1) Expected return of all N securities
- 2) Standard deviation of all N securities
- 3) Covariance between i^{th} and j^{th} security for $i, j = 1, 2, \dots, N$
- 4) Portfolio risk

V. REVIEW LITERATURE

The study by Blume, Crockett & Friend (1974) found that only about 11 percent of the individual investors held more than 10 securities. Another work by Conine, Jensen & Tamarkin (1989) refers to other studies on the empirical evidence of highly undiversified portfolios of majority of investors in the US. This trend has not changed in the recent year, (Goetzmann & Kumar 2001) it is further stated that very few (less than 10%) individuals have more than 10 securities. This trend is not restricted to the US investors.

Another study by Bark (1991) states that the Korean investors have highly undiversified portfolios. Such absence of diversification has also been observed in index tracking portfolios. It has been stated in Rudd (1980) that the majority of US index funds do not hold all securities in the chosen index. It has been stated that many index tracking mutual funds have only about 35 securities (Rudd, 1980) there is no unanimity on how many securities should be there in a well-diversified portfolio. It has been stated by Berk & DemMazro (2007) that almost all the benefits of diversification could be achieved with about all 30 securities. The study by Shaky & Smith (2005) states that about 481 securities are required to make an optimal portfolio size. The empirical relationship between portfolio size & its risk \ return has been studied in Evens Archer (1968).

It has concluded that all the benefits of diversification can be obtained by investing in only ten securities. Fisher & Lorie (1970) provided support for Evens & Archers argument with simulation results for various portfolio sizes based on all the stocks listed on the New York stock exchange. In this work, it is demonstrated that holding an eight stock portfolio can effectively reduce the diversification risk by approximately 80 percent, compared to a single securities. The exact analytical expression for the relationship between portfolio size & risk has been derived by Elton & Gruber (1977). It has been stated in Statman (1987) that a portfolio including 30-40 securities is sufficient to effectively achieve efficient diversification.

Markowitz's groundbreaking research on portfolio optimization was published in March 1952 in an article titled 'Portfolio Selection' in the Journal of Finance. Thirty-eight years passed before he was jointly awarded the Nobel Prize for Economics with Merton Miller and William Sharpe (Varian 1993:159f). Markowitz solved the problem of minimizing a portfolio's variance, given an expected return and covariance matrix of shares in a portfolio, and demonstrated the importance of this to investors. In 1958 Tobin included the risk-free asset, and showed that the set of efficient risk-return combinations was in fact a straight line, consisting of an optimal portfolio of risky assets and the riskless asset.

Tobin's (1958) addition of the risk-free asset to the set of risky assets re-defined the efficient frontier as a straight line. According to Tobin, all investors would select the optimal risky portfolio – the point where the straight line from the risk free rate is tangent to the efficient frontier. Individual investors will add more or less of the risk-free asset to their complete portfolios, according to their risk averseness. This implies that the only difference in approach amongst investors would be where they would position their portfolio along the straight line between the risk-free asset and the optimal risky portfolio. The straight line is therefore the capital allocation line (CAL).

The proper goal of portfolio construction would be to generate a portfolio that provides the highest return and the lowest risk. Such a portfolio would be known as the "optimal portfolio" (Kevin, 2001). All securities are affected by common macroeconomic factors so even extensive diversification cannot eliminate risk. The risk that always remains is called market risk - also referred to as systematic risk or non-diversifiable risk - and is attributable to market-wide risk sources. The risk that can be eliminated by diversification is called firm-specific risk, non-systematic risk or diversifiable risk (Bodie, Kane, & Marcus, 2000).

VI. PROBLEM OF RESEARCHER'S STUDY

Investors want to more capital appreciation, which we call as achieved expected return, to manage excess risk. Markowitz model indicated that how to diversified (proportion) portfolio from scrip one to scrip two on the basis of positive correlation among the scrip. So the investor can better judge for diversification and reach to efficient frontier. Efficient frontier indicated proportion of scrip for diversification.

“PORTFOLIO SELECTION USING MINIMAX APPROACH: BANKING SECTOR IN INDIA”

The title of the problem should not be overdone. Controversial subject should not become the choice of an average researcher. Too narrow or too vague problem should be avoided.

VII. OBJECTIVE OF THE STUDY

1. To know level of risk through variance on banks return.
2. To guide investor for better co efficient of correlation among banks.
3. To analyze overall portfolio risk to take decision for diversification.

SAMPLE SIZE

From sample universe, researchers have selected 2 banks from private sector & 1 bank from public sector.

- 1) HDFC bank
- 2) ICICI bank
- 3) SBI bank

VIII. SCOPE OF THE STUDY

The main aim of researcher is to find out the truth which is hidden and which has not been discovered as yet

- To identify the correlation between all 3 selected banks.
- To measure the performance of bank by assessing risk and return.
- To guide investors for better decision in portfolio selection and diversification

IX. HYPOTHESIS

H₀: There is no significance difference on selection of portfolio among banks

H₁: There is significance difference on selection of portfolio among banks

The investor's preference in risk estimation of portfolio selection problems is important as it influences investment strategies. According to minimax approach risk criterion which helps the investor to restrict the standard deviation for each of the available stocks. The investor choose their portfolio to have certain minimax property, it seems essential to ask why one need an alternative to the traditional portfolio selection theory which says that an investor maximized its expected utility with respect to probability distribution.

Min-maxrisk function is address the situation where the investor is conservative i.e. the maximum of risk of individual assets is chosen to be the risk criterion.

Fundamental Variable used for securities selection

	Fundamental criteria	ICICI BANK		HDFC BANK		SBI BANK	
		2012	2011	2012	2011	2012	2011
1	Market capitalization	(Rs Cr) 138,071.16		(Rs Cr) 153,000.71		(Rs Cr) 159,775.88	
2	Earnings per share	56.09	44.73	22.02	84.40	174.15	116.07
3	Book value per share (Rs)	524.01	478.31	127.52	545.53	1,251.05	1,023.40
4	Current ratio	0.13	0.11	0.08	0.06	0.05	0.04
5	Dividend payout ratio (cash profit)	30.36	31.76	20.54	20.16	20.80	23.24
6	Dividend per share	16.50	14.00	4.30	16.50	35.00	30.00
7	Earning retention ratio	67.19	64.49	77.30	77.29	77.45	74.03
8	Net operating profit per share (Rs)	346.19	281.04	138.66	524.34	1,776.47	1,504.34
9	Net profit margin (%)	16.14	15.91	15.93	16.09	9.73	8.55
10	Operating profit per share (Rs)	76.15	64.08	37.71	160.36	289.44	255.39
11	Quick ratio	16.71	15.86	6.20	6.89	12.05	8.50

Source: www.moneycontrol.com

Market capitalization, Earnings per share, Dividend per share, Net operating profit per share (Rs), of State Bank of India is higher as compared to ICICI and HDFC Bank, while Dividend payout ratio and Net profit margin (%) of ICICI & HDFC Bank is higher as compared to State Bank of India

- Portfolio in HDFC and SBI Banks
- Portfolio in ICICI and SBI Banks
- Portfolio in ICICI and HDFC Banks
- Portfolio in all three Bank

Markowitz assists in the selection of the most efficient portfolio by analyzing various possible portfolios of the given securities. This model is based on expected returns (mean) and the standard deviation (variance) of the various portfolios. It was proved by Markowitz that if investor balanced their investment in different securities, it was possible to reduce risk.

A. Portfolio in HDFC and SBI Banks

Expected Return	Risk	HDFC	SBI
36.81	0.99	1	0
29.69	1.08	0.8	0.2
20.57	1.17	0.6	0.4
11.89	1.31	0.3	0.7
1.21	1.44	0	1
Standard Deviation		6.19	10.17
Correlation Co – efficient	0.99		

Proportion	1 : 0	0.8 : 0.2	0.6 : 0.4	0.3 : 0.7	0 : 1
Expected Return	36.81	29.69	20.57	11.89	1.44
Portfolio Variance	38.32	8.72	0.43	27.95	103.43
Portfolio Risk	6.19	2.954	0.66	5.29	10.17

Table shows the portfolio on the basis of proportion of HDFC& SBI Bank's scrip. As per the expectation of investors he/she want to diversify portfolio as per the market proved return. It shows that if investor manage portfolio which is made up with proportion 0:1, it gives less return as compared to high level of risk, but if proportion of investment is 0.8:0.2, it gives more return with less risk.

B. Portfolio in ICICI and SBI Banks

Expected Return	Risk	ICICI	SBI
24.62	1.87	1	0
19.94	1.79	0.8	0.2
15.25	1.7	0.6	0.4
8.24	1.57	0.3	0.7
1.21	1.44	0	1
Standard Deviation		11.06	10.17
Correlation Co – efficient	-0.99		

Proportion	1 : 0	0.8 : 0.2	0.6 : 0.4	0.3 : 0.7	0 : 1
Expected Return	24.62	19.94	15.25	8.24	1.21
Portfolio Variance	122.32	46.79	7.13	14.92	103.43
Portfolio Risk	11.06	6.84	2.67	3.86	10.17

Table shows the portfolio on the basis of proportion of ICICI & SBI Bank's scrip. As per the expectation of investors he/she want to diversify portfolio as per the market proved return. It shows that if investor manage portfolio which is made up with proportion 0:1, it gives less return as compared to high level of risk, but if proportion of investment is 0.6:0.4, it gives more return with less risk.

C. Portfolio in ICICI and HDFC Banks

Expected Return	Risk	ICICI	HDFC
24.62	1.87	1	0
27.06	1.7	0.8	0.2
29.49	1.52	0.6	0.4
33.16	1.25	0.3	0.7
36.81	0.99	0	1
Standard Deviation		11.06	6.19
Correlation Co – efficient		-1	

Proportion	1 : 0	0.8 : 0.2	0.6 : 0.4	0.3 : 0.7	0 : 1
Expected Return	24.62	27.06	29.49	33.16	36.81
Portfolio Variance	122.32	57.91	17.31	1.03	38.32
Portfolio Risk	11.06	7.61	4.16	1.01	6.19

Table shows the portfolio of ICICI & HDFC Bank's scrip. As per the expectation of investors he/she want to diversify portfolio as per the market proved return. It shows that if investor manage portfolio which is made up with proportion 1:0, it gives less return as compared to high level of risk, but if proportion of investment is 0.3:0.7, it gives more return with minimum risk.

D. Portfolio in all three Banks

Expected Return	Risk	ICICI	HDFC	SBI
20.67	1.43	0.33	0.33	0.33
16.57	1.39	0.2	0.3	0.5
20.03	1.57	0.5	0.2	0.3
26.04	1.35	0.3	0.5	0.2

20.59	1.63	0.6	0.15	0.25
24.62	1.87	1	0	0
36.81	0.99	0	1	0
1.21	1.44	0	0	1
Standard Deviation		11.06	6.19	10.17
Correlation Co – efficient	0.5			

Table 4.2 Markowitz Portfolio Coefficient

Proportion	33:33:33	20:30:50	50:20:30	30:50:20	60:15:25	1:0:0	0:1:0	0:0:1
Expected Return	20.67	16.57	20.03	26.04	20.59	24.62	36.81	1.21
Portfolio Variance	2.2	9.4	318.92	1.41	25.97	122.32	38.32	103.43
Portfolio Risk	1.48	3.07	17.86	1.19	5.09	11.06	6.19	10.17

Table shows the portfolio on the basis of proportion of ICICI, HDFC& SBI Bank's scrip. As per the expectation of investors he/she want to diversify portfolio as per the market proved return. It shows that if investor manage portfolio which is made up with proportion 0:0:1, it gives less return as compared to high level of risk, but if proportion of investment is 0.3:0.5:0.2, it gives more return with less risk.

X. LIMITATION OF THE STUDY

Researcher selected only three banks, also sample size is small. Investors have never focus on diversification proportion of the scrip, which effected risk on average return. Accurate information might not have been available, based on secondary data. Researcher has used Markowitz Model which is complex for computation, so that investors can't properly understand the fundamental logic for this model and how set of efficient frontier for diversification.

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