

PORTFOLIO SELECTION: RISK REDUCTION BY DIVERSIFICATION

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ABSTRACT

Investors have always intuitively believed that diversification leads to risk reduction. However, it was in early 1950s that Harry Markowitz formally developed the concept of portfolio diversification. With the stock markets bouncing up and down, individual investors clearly need a safety net. Diversification can work this way. Total risk can be divided into two parts: Unsystematic risk, systematic risk. Unsystematic risk is also called diversifiable risk. It is that portion of total risk that is peculiar or unique to a firm. Systematic risk is that portion of total risk caused by factors affecting all the economy. The objective of the study is to test whether diversification leads to risk reduction without loss of return in Indian stocks. The present study analyze 20 companies stocks from specified group, listed on Bombay stock exchange and whose shares are frequently traded, covering a period of three years from 1st January, 2004 to 31st December, 2006. For each share the standard deviation of returns is then computed. The average of all standard deviation shows average risk for these one-security portfolios. This process is repeated as the number of securities in each portfolio is gradually raised. The study indicates that Ten-security portfolios average risk is lowest i.e. 7.25 as compare to average risk of individual stock i.e. 11.03 per cent.

Keywords: *Portfolio, Risk, Standard deviation, Unsystematic risk, Systematic risk, Beta.*

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'Do not put all your eggs into one basket' is an old adage. Investors have always intuitively believed that diversification leads to risk reduction. However, it was in early 1950s that Harry Markowitz formally developed the concept of portfolio diversification. In a seminal article, 'Portfolio Selection' Markowitz (1952) originated the basic portfolio model in which he showed quantitatively why, and how diversification leads to risk reduction without any loss of return. Markowitz provides the foundation for the modern theory of portfolio management. Individuals will have different tolerances for risk. Tolerance is not static; it will change as your life does. As you grow older tolerance will usually shrink as more and more obligations come up, including retirement. There are several different types of risks involved in financial transactions. Achieving the right balance between risk and return will ensure that you achieve your financial goals while allowing you to get a good night's rest. With the stock markets bouncing up and down, individual investors clearly need a safety net. Diversification can work this way and can prevent your entire portfolio from losing value.

What do you need to have a well diversified portfolio? There are three main things you should do to ensure that you are adequately diversified:

Your portfolio should be spread among many different investment vehicles such as cash, stocks, bonds, mutual funds, and perhaps even some real estate.

1. Your securities should vary in risk. You're not restricted to picking only blue chip stocks. In fact, the opposite is true. Picking different investments with different rates of return will ensure that large gains offset losses in other areas. Keep in mind that this doesn't mean that you need to jump into high-risk investments.
2. Your securities should vary by industry, minimizing unsystematic risk to small groups of companies. Another question is how many stocks one should buy to reduce the risk of their portfolio. The portfolio theory tells us that after 10-12 diversified stocks, you are very close to optimal diversification. This doesn't mean buying 12 internet or tech stocks will give you optimal diversification. Instead, you need to buy stocks of different sizes and from various industries.

Total risk can be divided into two parts: Unsystematic risk, systematic risk. Unsystematic risk is also called diversifiable risk. It is that portion of total risk that is peculiar or unique to a firm. Factors such as consumer preferences, plant break down labour strikes, competition, management ability; development of a new product, access to a new market, etc. are a few examples of unsystematic variability. As we know that investors don't like risk, so it is not necessary for investors to accept the total risk of an individual security; investors can and do diversify. Some of the risk associated with an individual security can be avoided by

diversification. With diversification the investor can eliminate unsystematic risk, to a great extent. Figure 1.1 shows how some of the total risk associated with individual securities can be avoided by diversification. Investment in a single security implies acceptance of total risk, so it is not advisable for investors to put all their funds into a single investment as this exposes them to more risk than is necessary for the expected return. Figure 1.1 shows that if investor increases the number of investment holding from 1 to 2, 3, 4, and so on, investor achieves considerable portfolio risk reduction. This happens because surprise bad news for a company is off set by surprise good news for another company. These good and bad shocks specific to individual companies cancel out each other. Company A launches a successful new product, while Co. B launches a failure product. Company C makes a breakthrough in design, while company D has a sudden damaging strike. These events are specific to individual company and are unrelated to general movements in the economy. The result of diversification is reduction in portfolio volatility i.e. reduction in portfolio risk. Unsystematic risk may be called diversifiable risk, unique risk, avoidable risk and non-market risk.

Systematic risk may be called non-diversifiable risk, unavoidable risk or market risk. Systematic risk is that portion of total risk caused by factors affecting all the economy, such as interest rate, money supply, taxation, exchange rates, prices of commodities, govt. spending and monsoon. To some extent, the fortunes of all the companies move with the economy. Factors as mentioned above affect all companies to some greater or lesser extent. So, total risk of a security is the sum of specific risk and market risk, and specific risk can be removed by diversification. We should not expect competitive markets to reward investors for taking risks, which they can avoid, and we should, therefore, expect rewards to be related only to market risk whose normalized measure is beta.

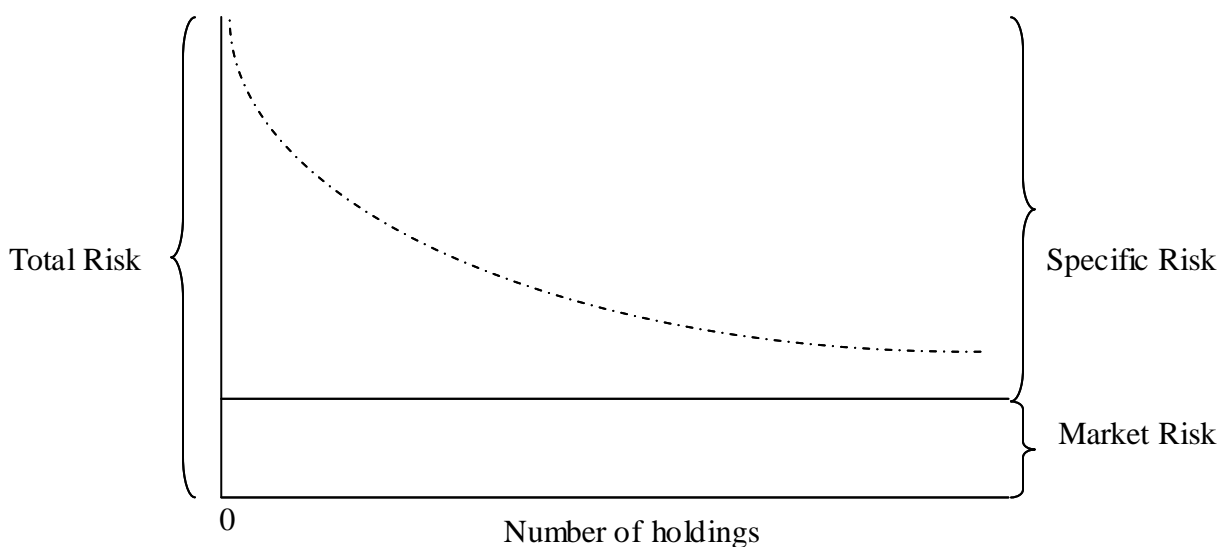


Figure 1.1 Risk Reduction by Diversification

Objectives of the Study

The objective of the study is to test whether diversification leads to risk reduction without loss of return in Indian stocks. So, the present study tests whether the process of diversification leads to risk reduction in Indian capital market as number of empirical studies shown for developed stock market.

Data Base and Methodology

The most common single indicator of an asset's risk is the standard deviation, (σ) which measures the dispersion of its return. It can be measured as follows.

$$\sigma = \sqrt{\frac{\sum (R_i - \bar{R}_i)^2}{n - 1}}$$

R_i = Return on investment

\bar{R}_i = Average return

N = Number of observations.

The computation of return on a portfolio is simple and straight exercise. However, the computation of risk as measured by standard deviation of returns from a portfolio is not. The expected return of a portfolio comprising 'n' securities is the weighted average of the expected return of each security in the portfolio:

$$E(R_p) = \sum_{i=1}^n W_i E(R_i)$$

Where W_i = Proportion of security i in the portfolio.

$E(R_i)$ = Expected return on security i

If a investor has two securities in his portfolio, expected return is given by equation:

$$E(R) = W_1 E(R_1) + (1 - W_1) E(R_2)$$

$$1 - W_1 = W_2 \quad \text{So } W_1 + W_2 = 1$$

Now the risk of a portfolio is measured by the variance of its return, and this is determined by the variance of return of each security and covariance of returns between each pair of the securities:

$$\sigma_p^2 = \sum_{i=1}^n W_i^2 \sigma_i^2 + 2 \sum_{i=1}^n \sum_{j=1}^n W_i W_j \sigma_{ij}$$

σ_p^2 = Variance of return of the portfolio.

σ_i^2 = Variance of return of security i .

σ_{ij} = Covariance of return between security i and security j .

$$\sigma_{ij} = r_{ij} \sigma_i \sigma_j$$

r_{ij} = Correlation between security i and security j.

It is important to note that the variance of a portfolio is determined by correlation of return between each pair of securities, as well as the variance of return of each security. In the two-asset portfolio:

$$\sigma_p^2 = W_1^2 \sigma_1^2 + W_2^2 \sigma_2^2 + 2 W_1 W_2 r_{12} \sigma_1 \sigma_2$$

Data

The present study analyze 20 companies stocks from specified group, listed on Bombay stock exchange and whose shares are frequently traded, covering a period of three years from 1st January, 2004 to 31st December, 2006. We used monthly returns on the stocks. Monthly prices of 20 sample companies have been collected and monthly holding period returns are calculated for further computation. The sample securities, which are considered, are given below:

1. ABB LTD
2. ACC LTD
3. BAJAJ AUTO LTD
4. BHARTI ARTL
5. BHEL
6. GRASIM INDUSTRIES LTD
7. HDFC BANK
8. HEROHONDA MOTORS
9. HINDUSTAN LEVER LTD
10. HOUSING DEVELOPMENT FINANCE CO
11. ICICI BANK LTD
12. LARSEN & TOUBRO LTD
13. MAHANAG TELE LTD
14. MARUTI UDYOG LTD
15. RELIANCE ENREGY LTD
16. RELIANCE LTD
17. STATE BANK OF INDIA
18. STEEL AUTHORITY OF INDIA
19. TATA MOTORS
20. TATA STEEL

The process of diversification leading to risk reduction has been shown by number of empirical studies conducted for developed stock markets. Markowitz (1952) originated the basic portfolio model, Brealy (1983) showed that a portfolio of ten stocks provides 88.5 per cent of the maximum possible advantage of diversification. In another study Evans and Archer (1988) obtained the similar results. Gruble (1968) explained the potential gains to US investors from diversifying their portfolio internationally. Levy and Sarnet (1970) also used the Markowitz model of portfolio choice to examine the potential to US investors. Dimson (1980) also explained the similar benefits from diversification.

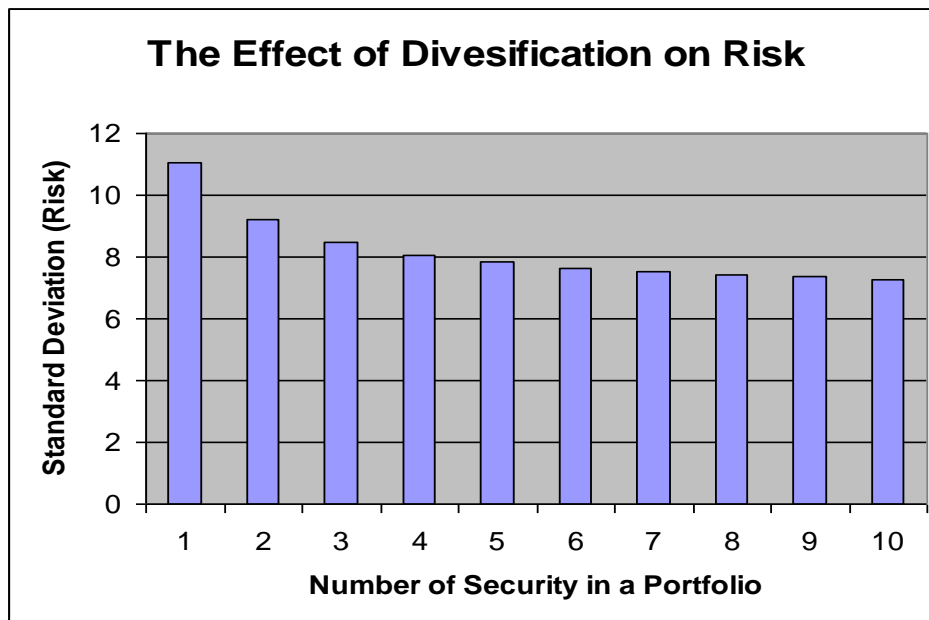
RESULTS

In the present study, monthly returns are calculated for each share. Return for each share for all monthly periods are calculated for a three year time horizon, from January 2004 to December 2006. For each share the standard deviation of returns is then computed. The average of all standard deviation shows average risk for these one-security portfolios. Then the number of securities in each portfolio raised to two. An equal number of twenty portfolios of two securities are constructed by overlapping. Then standard deviation of returns for each two-security portfolio is computed and the average of standard deviation of all such portfolios is then considered as a measure of average risk when there are two securities in each portfolio. This process is repeated as the number of securities in each portfolio is gradually raised. Finally, there are twenty portfolios of ten-security each. The results of the study are given below:

Table: Diversification and Risk Reduction

Number of securities in a portfolio	Average standard deviation (RISK)	Average Return
1	11.03772	2.83656
2	9.208346	2.83656
3	8.482286	2.83656
4	8.078724	2.83656
5	7.829234	2.83656
6	7.652595	2.83656
7	7.51908	2.83656

8	7.427945	2.83656
9	7.353912	2.83656
10	7.257304	2.83656



The study indicates that the total risk for an individual stock is about 11.03 per cent on average. It is apparent from the study that when number of securities increased in the portfolio then risk is reduced. Two-security portfolio average risk is 9.20 as compare to one-security average risk 11.03. It is observed that marginal risk reduction is quite significant in the initial stages but declines gradually. Ten-security portfolios average risk is lowest i.e. 7.25. But average return remains the same i.e. 2.86. . So, the present study finds that diversification leads to risk reduction in Indian capital market.

APPENDIX – A
Standard Deviation

PORTFOLIO	1	2	3	4	5	6	7	8	9	10
One-Security Portfolio	11.73	12.09	9.36	11.08	13.58	10.12	13.46	16.19	10.26	12.53
Two-Security Portfolio	9.70	8.65	8.30	10.32	10.40	10.75	11.39	10.72	10.04	11.85
Three-Security Portfolio	7.95	7.92	8.65	9.37	10.81	9.70	9.86	9.66	10.07	9.78
Four-Security Portfolio	7.69	7.76	8.37	9.79	9.82	9.20	9.52	9.34	9.10	8.42
Five-Security Portfolio	7.55	7.70	8.93	9.30	9.25	9.21	9.18	8.67	8.16	7.70
Six-Security Portfolio	7.57	8.18	8.60	8.95	9.19	8.99	8.65	8.04	7.62	7.23
Seven-Security Portfolio	7.95	7.99	8.37	8.91	8.89	8.59	8.13	7.56	7.25	6.98
Eight-Security Portfolio	7.80	7.93	8.44	8.64	8.54	8.18	7.69	7.22	7.02	6.99
Nine-Security Portfolio	7.81	8.04	8.24	8.43	8.15	7.80	7.36	7.02	7.04	7.15
Ten-Security Portfolio	7.93	7.96	8.09	8.09	7.80	7.48	7.15	7.07	7.21	7.03

	11	12	13	14	15	16	17	18	19	20	AVERAGE
	15.25	10.86	9.61	8.92	8.02	7.29	11.33	11.50	8.99	8.60	11.038
	10.34	8.13	8.31	6.79	6.51	7.85	10.14	9.17	6.74	8.06	9.208
	8.11	7.85	6.95	6.49	6.90	8.21	8.95	7.64	7.08	7.68	8.482
	7.40	6.98	6.64	6.54	7.41	7.88	7.93	7.79	7.05	6.95	8.079
	6.91	6.74	6.68	6.93	7.25	7.23	7.95	7.64	6.64	6.97	7.829
	6.69	6.75	6.86	6.89	6.90	7.40	7.69	7.09	6.87	6.91	7.653
	6.68	6.91	6.78	6.65	7.06	7.30	7.24	7.21	6.89	7.05	7.519
	6.93	6.87	6.62	5.82	5.18	6.97	7.31	7.15	7.01	7.41	7.428
	6.84	6.70	6.72	6.79	6.73	7.07	7.27	7.23	7.33	7.36	7.354
	6.68	6.03	6.67	6.55	6.85	7.03	7.32	7.48	7.29	7.43	7.257

APPENDIX – B

Average Return

PORTFOLIO	1	2	3	4	5	6	7	8	9	10
One-Security Portfolio	5.67	0.62	2.79	2.73	2.83	2.08	1.43	1.83	2.74	0.96
Two-Security Portfolio	3.14	1.70	2.76	2.78	2.46	1.76	1.63	2.29	1.85	2.62
Three-Security Portfolio	3.03	2.05	2.78	2.55	2.11	1.78	2.00	1.85	2.66	3.01
Four-Security Portfolio	2.95	2.24	2.61	2.27	2.04	2.02	1.74	2.45	2.94	2.46
Five-Security Portfolio	2.93	2.21	2.37	2.18	2.18	1.81	2.25	2.72	2.52	2.58
Six-Security Portfolio	2.79	2.08	2.28	2.28	1.98	2.22	2.50	2.41	2.60	2.45
Seven-Security Portfolio	2.59	2.05	2.35	2.09	2.31	2.44	2.27	2.49	2.49	2.60
Eight-Security Portfolio	2.50	2.13	2.17	2.36	2.49	2.24	2.36	2.41	2.62	2.69
Nine-Security Portfolio	2.53	2.00	2.41	2.52	2.31	2.33	2.30	2.53	2.70	2.95
Ten-Security Portfolio	2.37	2.23	2.55	2.35	2.38	2.28	2.42	2.61	2.93	3.14

11	12	13	14	15	16	17	18	19	20	AVERAGE
4.27	3.79	0.83	3.02	1.81	3.54	3.30	5.02	4.88	3.14	2.86
4.03	2.31	1.93	2.42	2.67	3.42	4.16	4.95	4.01	4.40	2.86
2.96	2.55	1.89	2.79	2.88	3.95	4.40	4.35	4.56	3.14	2.86
2.98	2.36	2.30	2.92	3.42	4.19	4.09	4.68	3.58	3.05	2.86
2.74	2.60	2.50	3.34	3.71	3.98	4.40	3.87	3.42	2.99	2.86
2.88	2.72	2.92	3.60	3.62	4.26	3.77	3.69	3.31	2.96	2.86
2.94	3.04	3.20	3.53	3.91	3.74	3.63	3.55	3.24	2.84	2.86
3.20	3.27	3.19	3.09	2.71	3.62	3.52	3.46	3.09	2.66	2.86
3.39	3.26	3.47	3.44	3.42	3.52	3.44	3.31	2.91	2.57	2.86
3.36	2.93	3.18	3.38	3.35	3.45	3.31	3.12	2.80	2.59	2.84

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