SYSTEMATIC RISK: TESTING OF THE RELATIONSHIP OF BETAS OVER TIME

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Abstract:

'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. Total risk can be divided into two parts: Unsystematic risk, Systematic risk. 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 Systematic risk whose normalized measure is beta. The objective of present paper is to see how much association is there in historical betas with future betas. For this purpose, the correlation between betas of one period with the betas of adjacent period of the same 150 securities as well as 10 portfolios betas of 150 companies are calculated. Therefore, 15 portfolios of 10 securities each are constructed in a manner that portfolio 1 is the smallest betas portfolio, and portfolio 15 is the highest betas portfolio. The study found that the correlation between the individual securities betas is 0.5, but for the portfolio betas of 10 securities each is 0.78 for the period T. Therefore, the correlations between portfolios betas are high, as compared to the securities betas, over successive periods. The same results are obtained for sub-periods t_1, t_2, and t_3. Blume (1975) has done extensive testing of the relationship between betas over time. He also found that historical betas on the portfolios are better predictors of future betas than are historical betas on individual securities. So, we can conclude that betas of portfolios of one period with the betas of adjacent period are associated closely as compared to individual betas.

Keywords: Systematic Risk, Beta, Standard Deviation, Co-Variance, Correlation

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Introduction:

'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.

Subsequent efforts were also made to examine the relationship between risk and return and it was only by Sharpe (1964) that has made a notable presence. The model that explained the relationship between risk and return is today widely known as Capital Asset Pricing Model. The capital asset pricing model, almost always referred to as the CAPM, is a centerpiece of modern financial economics. This model was simultaneously and independently developed by linter (1965), Mossin (1966). The Markowitz modern portfolio theory provides conceptual foundation for the CAPM. The CAPM provides a precise predication of the relationship we should observe between the risk of an asset and its expected return.

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. 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, and prices of commodities, govt. spending and monsoon. 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.

The risk of a well-diversified portfolio, as we have seen, is represented by its market risk. As Brealey and Myers put it "The risk of a well diversified portfolio depends on the market risk of the securities included in the portfolio. Tattoo this statement on your forehead if you can't remember it any other way." So it is possible to reduce unsystematic risk by adding different

securities to the investor portfolio and it has been found that by adding about 10–15 securities to the portfolio, the total risk can be reduced to the level of systematic risk.

Objective of the study:

The objective of present paper is to see how much association is there in historical betas with future betas. For this purpose, the correlation between betas of one period with the betas of adjacent period of the same 150 securities as well as 10 portfolios betas of 150 companies are calculated. We compare the betas of individual securities as well as portfolios betas of initial estimation period with those of the testing period.

Data and Methodology:

In the present study, we take four periods of analysis with different starts, and ends with weekly data frequencies. These periods can be seen in the Table given below.

Table: Study Periods

Symbols	Study period	Initial estimation period	Testing period
T	1.1.1995-31.12.2001	1.1.1995-10.7.1998	17.7.1998-31.12.2001
t_1	1.1.1995-10.7.1998	1.1.1995-11.10.1996	18.10.96-10.7.1998
t_2	18.10.1996-31.3.2000	18.10.1996-10.7.1998	17.7.1998-31.3.2000
t_3	17.7.1998-31.12.2001	17.7.1998-31.3.2000	7.4.2000-31.12.2001

In the above table T period covers 180 observations for each stock for initial estimation period as well as for testing period. Similarly, sub-periods t_1, t_2 and t_3 cover 90 observations for each stock.

Calculation of Total Risk

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

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

R_i = Return on investment

$\bar{R}_i$ = Average return

N = Number of observations.

Calculation of BETA i.e. Systematic Risk

As stated earlier, beta is a measure of systematic risk. Beta co-efficient is the function of co-variance of return on asset i with return on market portfolio. As pointed out in Fama and MacBeth (1973), an error in the variable problem is unavoidable while testing the two-parameter model due to the fact that the expected return risk equation is in terms of true values of the relative risk measure, which is, obviously, not operational. Therefore, its estimate, β, is employed

$$\beta_i = \frac{\text{Cov.}(R_i, R_M)}{\text{Var.}(R_M)}$$

We have estimated betas for each 150 individual sample stocks for initial estimation period under study periods T, t_1, t_2 and t_3. Portfolios betas are calculated after arranging the stocks in ascending order of their betas values in each initial estimation period. Then 15 equal weighted portfolios of 10 stocks each are made. Portfolio 1 is the lowest risk portfolio and portfolio 15th the highest risk portfolio. The portfolio beta is calculated by the following formula:

$$\beta_P = \sum_{i=1}^{10} W_i \beta_i$$

Calculation of Holdings Period Return

In calculating HPR, both price appreciation and dividend yield is considered.

$$\text{ROR} = \frac{D_t + (P_t - P_{t-1})}{P_{t-1}}$$

ROR= Rate of return.

D_t - is the dividend of the stock during the time period t-1 to t.

P_t - is the price of stock at time t.

P_{t-1} – is the price of stock at time period t-1.

In our study, dividend is adjusted on received basis.

Bonus Issue also affects the ROR. When a company makes a bonus issue, it means that an investor gets more shares for the same investment. Hence, the ROR increases. It is adjusted by the following manner

$$ROR = \frac{D_t \times \frac{n_t}{n_{t-1}} + \left(P_t \times \frac{n_t}{n_{t-1}} - P_{t-1} \right)}{P_{t-1}}$$

Where n_t – Number of share including bonus shares.

n_{t-1} – Number of share excluding bonus share.

Right Issue: It affects the ROR. Value of a Right is calculated as follows. 'The right' a shareholder gets to subscribe to share has a value.

$$\text{Value of a right} = \frac{P_0 - S}{N+1}$$

P_0 = Market price per share

S = Subscription Price

N = Number of shares required for a right share.

When we included the value of a 'Right' in the Calculation of the ROR then:

$$ROR = \frac{D_t + (P_t - P_{t-1}) + \text{Value of a right}}{P_{t-1}}$$

The Market Proxy

As specified by CAPM, beta is the co-variance of return on asset i with return on market portfolio. But composition of the market portfolio is not precisely known because market portfolio includes all the risky assets like real estate, coins, bonds, and stamps. So, in the present study, beta is calculated by using the Market Index in place of market portfolio. BSE-National Index, BSE-200, BSE-Sensex, NSE-50 (Nifty) and Crisil-500 are the different indexes, which can be chosen as market proxy.

In the present study, BSE-National Index is chosen as market proxy. This series of BSE-National Index has been started by Bombay Stock Exchange in 1988-89 with the base year 1983-84 = 100. This series has 100 scrips from all industrial groups. The equity shares of 100 companies from both the specified and non-specified group of the five major stock exchanges, namely Bombay, Calcutta, Delhi, Ahemedabad and Madras have been selected for the purpose of compiling the BSE-National Index.

Results:

We have computed correlation between betas of one period with the betas of adjacent period of the same securities to see how much association is there in historical betas and future betas. In the present study, we have compared the betas of individual securities as well as portfolios betas of initial estimation period with those of the testing period, during study period T, period t_1, period t_2, and period t_3. Portfolios betas are computed after arranging the stocks in ascending order of their beta values in the initial estimation period during study period T, period t_1, period t_2, and period t_3. Therefore, 15 portfolios of 10 securities each are constructed in a manner that portfolio 1 is the smallest betas portfolio, and portfolio 15 is the highest betas portfolio. The results are shown in following Table.

Table: Correlations between Betas of Portfolio of Initial Estimation Periods with Testing Periods

Number of securities In the Portfolio	**Correlation Co-efficient**			
	Period T	**Period t_1**	**Period t_2**	**Period t_3**
1	0.50	0.37	0.40	0.65
10	0.78	0.67	0.83	0.89

Table above represents the correlation between the individual securities betas, as well as for the portfolio betas of 10 securities each, for the period T, i.e., period 1.1.1995-10.7.1998 and period 17.7.1998-31.12.2001, is 0.50 and 0.78 respectively. Therefore, the correlations between portfolios betas are high, as compared to the securities betas, over successive periods. The same results are obtained for sub-periods t_1, t_2, and t_3. Blume (1975) has done extensive testing of the relationship between betas over time. He found that historical betas on the portfolios are better predictors of future betas than are historical betas on individual securities and also found that portfolio betas are measured with less error and change less than betas on securities. So, we can conclude that betas of portfolios of one period with the betas of adjacent period are associated closely as compared to individual betas.

BIBLIOGRAPHY

1. Black, Fisher (1972), 'Capital Market Equilibrium with Restricted Borrowing', *Journal of Business*, July, Vol. 45, 445-55.

2. Blume, M. (1975), 'Beta and Their Regression Tendencies, Some Further Evidence', *Journal of Finance*, June, Vol. 30, pp. 785-796.

3. Blume, M., and I. Friend (1973), 'A New Look at the Capital Asset Pricing Model. *Journal of Finance*, March, Vol. 28, pp. 19-33.

4. Blume, M., and R. Stambaugh (1983), 'Biases in Computed Returns : An Application to the Size Effect', *Journal of Financial Economics*, Vol. 12, pp. 387-404.

5. Blume, M.E. (1970), 'Portfolio Theory : A Step towards its Parctical Applications', *Journal of Business*, Vol. 43, pp. 152-73.

6. Daves, R.P., M.C. Ehrhardt and R.A. Kunkel (2000), 'Estimating Systematic Risk : The Choice of Return Interval and Estimation Period', *Journal of Financial and Strategic Decisions*, Vol. 13, No. 1, pp. 7-13.

7. Dhankar Raj, S. (1996), 'An Empirical Testing of CAPM in the India Contest', *Journal of Financial Management and Analysis*, Vol. 9, No. 2, pp. 9-15.

8. Dimson, E., and P. Marsh (1979), 'Modern Risk Measurement', *Managerial Finance*, Vol. 5, No. 1, pp. 80-6.

9. Dimson, Elroy (1979), 'Risk Measurement when Shares are Subject to Infrequent Trading', *Journal of Financial Economics*, June, Vol. 7, No. 2, pp. 197-226.

10. Douglus, G.W. (1968), 'Risk in the Equity Market : Application of Market Efficiency', *Yale Economic Essays*, Vol. 9, pp. 3-45.

11. Ng, L. (1991), 'Tests of the CAPM with Time-Varying Covariances: A Multivariate GARCH Approach', *Journal of Finance*, Vol. 46, pp. 1507-1521.

12. Obaidullah, M. (1991), 'The Distribution of Stock Returns', *Chartered Financial Analyst*, November.

13. Obaidullah, M. (1991a), 'Earnings, Stock Prices & Market Efficiency : Indian Evidence. Securities Industry Review', *Journal of the Singapore Securities Research Institute*, October.

14. Obaidullah, M. (1991b), 'The Price-Earnings Ratio Anomaly in Indian Stock Markets', *Decision*, July-Sept.

15. Obaidullah, M. (1993), 'Does the CAPM Explain Actual Price Behaviour', *Chartered Financial Analyst*, Nov.

16. Palaha, Satinder (1991), 'Cost of Capital and Corporate Policy', *Anmol Publications*.

17. Pettengill, G. N., S. Sundaram and I. Mathur (1995), 'The Conditional Relation Between Beta and Returns', *The Journal of Financial and Quantitative Analysis*, Vol. 30, pp. 101-116.

Appendix

Name of Companies

ASHOK LELAND LTD.	Grasim Industries Ltd.	Oriental Hotels Ltd.
Bajaj Auto Ltd.	Hindustan Lever Ltd.	Royale Manor Hotels & Inds. Ltd.
Escorts Ltd.	ICI India Ltd.	Sterling Holiday Resorts (India) Ltd.
Hero Honda Motors Ltd.	Indian Rayon & Inds. Ltd.	Suman Motels Ltd.
Kinetic Engineering Ltd.	Kesoram Industries Ltd.	Viceroy Hotels Ltd.
Kinetic Motor Co. Ltd.	Larsen & Toubro Ltd.	Colgate-Palmolive (India) Ltd.
LML Ltd.	Oswal Agro Mills Ltd.	Fem Care Pharma Ltd.
Mahindra & Mahindra Ltd.	Raymond Ltd.	Gillette India Ltd.
Swaraj Mazda Ltd.	Reliance Industries Ltd.	Godrej Industries Ltd.
Tata Engineering & Locomotive Co. Ltd.	Tata Chemicals Ltd.	P & G Hygiene & Health Care Ltd.
Eicher Ltd.	Voltas Ltd.	Ray Ban Sun Optics India Ltd.
Eicher Motors Ltd.	Amara Raja Batteries Ltd.	Reckitt Benckiser (India) Ltd.
TVS Motor Co. Ltd.	Asea Brown Boveri Ltd.	Alpha Drug India Ltd.
Bank of Rajasthan Ltd.	Asian Electronics Ltd.	Burroughs Wellcome (India) Ltd.
Federal Bank Ltd.	Bharat Bijlee Ltd.	Cipla Ltd.
Global Trust Bank Ltd.	Bharat Heavy Electricals Ltd.	Dr. Reddy's Laboratories Ltd.
Nedungadi Bank Ltd.	Birla Yamaha Ltd.	Fulford (India) Ltd.
Oriental Bank of Commerce	Crompton Greaves Ltd.	German Remedies Ltd.
State Bank of India	Emco Ltd.	Glaxosmithkline Pharmaceuticals Ltd.
United Western Bank Ltd.	Honda Siel Power Products Ltd.	Knoll Pharmaceuticals Ltd.
Associated Cement Cos. Ltd.	BPL Engineering Ltd.	Merck Ltd.
Dalmia Cement (Bharat) Ltd.	BPL Ltd.	Morepen Laboratories Ltd.
Gujarat Ambuja Cements Ltd.	BS Refrigerators Ltd.	Nicholas Piramal India Ltd.
India Cements Ltd.	BST Ltd.	Parke-Davis (India) Ltd.
Madras Cements Ltd.	JCT Electronics Ltd.	Pfizer Ltd.
Mangalam Cement Ltd.	Kalyani Sharp India Ltd.	Ranbaxy Laboratories Ltd.
Shree Cement Ltd.	Mirc Electronics Ltd.	Sun Pharmaceutical Inds. Ltd.
Prism Cement Ltd.	Philips India Ltd.	Wockhardt Lifesciences Ltd.
National Peroxide Ltd.	Siemens Ltd.	Zandu Pharmaceutical Works Ltd.
Tanfac Industries Ltd.	Tata Honeywell Ltd.	Chowgule Steamships Ltd.
Ficom Organics Ltd.	Videocon International Ltd.	Essar Shipping Ltd.
Deepak Nitrite Ltd.	Videocon Communications Ltd.	Garware Shipping Corpn. Ltd.
Citurgia Biochemicals Ltd.	Avery India Ltd.	Great Eastern Shipping Co. Ltd.

Aarti Industries Ltd.	Bharat Earth Movers Ltd.	Mercator Lines Ltd.
Transpek Industry Ltd.	DGP Windsor India Ltd.	Varun Shipping Co. Ltd.
DSQ Software Ltd.	Kirloskar Oil Engines Ltd.	Bhushan Steel & Strips Ltd.
HCL Infosystems Ltd.	Manugraph India Ltd.	Essar Steel Ltd.
Infosys Technologies Ltd.	Swaraj Engines Ltd.	Mukand Ltd.
Mphasis BFL Ltd.	UB Engineering Ltd.	Steel Authority of India Ltd.
NIIT Ltd.	Bata India Ltd.	Tata Iron & Steel Co. Ltd.
Pentamedia Graphics Ltd.	Bhartiya International Ltd.	Goodricke Group Ltd.
Rolta India Ltd.	Phoenix International Ltd.	Sterling Biotech Ltd.
Satyam Computer Services Ltd.	Arvind Mills Ltd.	Tata Tea Ltd.
Silverline Technologies Ltd.	Ashima Ltd.	Alok Industries Ltd.
Tata Elxsi Ltd.	Eskay K'N'It (India) Ltd.	Arvind Mills Ltd.
Tata Infotech Ltd.	Madura Coats Ltd.	Bombay Dyeing & Mfg. Co. Ltd.
Wipro Ltd.	EIH Ltd.	KG Denim Ltd.
Bombay Burmah Trdg. Corpn. Ltd.	Hotel Leela Venture Ltd.	Mafatlal Industries Ltd.
Century Textiles & Inds. Ltd.	ITC Hotels Ltd.	Morarjee Goculdas Spg. & Wvg. Co. Ltd.
EID-Parry (India) Ltd.	Indian Hotels Co. Ltd.	S Kumars Nationwide Ltd.