Portfolio construction using sharpe method

Finance, Investment

PORTFOLIO CONSTRUCTION USING SHARPE METHOD A PROJECT REPORT

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Modern Approach. The traditional Approach The traditional approach is based on Current Income and Capital Appreciation. Traditional approach starts with the analysis of constraints andetermine the objectives of investment, after which, the type of portfolio is selected. The portfolio can comprise of Bonds and Stock or only Bonds or only Common Stocks. After selecting the type of portfolio the risk and return of the selected type is assessed. The last step of Traditional approach is diversification. The Modern Approach The Modern Approach constructs a portfolio to maximize the return from a portfolio at the given level of risk. This theory was put forward by Harry Markowitz in his article " Portfolio Selection," published in 1952 by the Journal of Finance. There are many models for Modern Approach. The first one was Markowitz Model, and then came Sharpe Model. In an ideal case we need a portfolio with securities or stocks with perfect negative correlation. Another method is Capital Asset Pricing Model. It is a relationship explaining how assets should be priced in the capital market. Markowitz is considered to be the father is modern approach. In Markowitz Model we consider only the Unsystematic Risk for the construction of the portfolio. In this model we have to calculate the co variation between each and every stock in the portfolio. If there are “ n" numbers of stock in the portfolio, then it will become a hectic task to calculate the co variation between the “ n" numbers of stocks, which comes around $(n^2-n)/2$ calculations. William Sharpe is one who tried to simplify the Markowitz model for portfolio construction. According to him, instead of finding the relationship between each and every securities in the portfolio, it’s apt to find the relationship between the individual security and a common index, that common index is the market

index. That is, to abandon the covariance of each security with each other security and to substitute information on the relationship of each security to the market. This approach significantly reduced the computational requirement of Markowitz model. In the case of Capital Asset Pricing Model there are many assumptions, such as: * Investors can borrow or lent any amount of money at risk free rate of return. * An individual cannot affect the price of stock. * Investors make their investment decision based on expected return, standard deviation and covariance of security. * All investor expect the same rate of return and risk. * There is no transaction cost. * There is no corporate tax or income tax. Need for Study In today’s world, portfolio construction is the best way in investing in the financial market. Hence, time to time, new forms of sectors and segmentations are formed to categorize vaious companies on such parameters. This study helps us understand the optimum portfolio construction with the combination of mid cap securities and large Cap securities. Optimum portfolio is one which gives maximum return for the given level of risk. Objective The main objective of this project is to find the optimum portfolio from the selected companies in Mid Cap Sector and Large Cap Sectors sectors. Mid Cap companies are those that have a market capital between 2000 to 10, 000 Cr while Large Cap companies are those with market cap of 10. 000 Cr plus. At the end of the analysis a portfolio of five stocks with maximum return for a given risk is constructed. Limitations The data used to construct the optimum portfolio is only of five years. The five year data used is from 01-April-2006 to 31-March-2011. In Sharpe model we use only the movement of market index and the individual stock price. No other factors related to the industry or related to

the economy are considered for finding the optimum portfolio. Another limitation of Sharpe model is that it is sophisticated and the volume of computation associated is large when compared to other methods. Literature Review R Stanfford Johnson and Richard A Zuber, 2011: The increasing variability in the exchange rates over the last decade has led to studies suggesting that there are potential exchange- rate risk reduction benefits to be gained by expressing the prices of international products and assets in terms of a portfolio of currencies, that is , a s a currency cocktails. In 1977 article published by Aubey and Cramer (A & C) showed how a cocktail consisting of the Yen, mark and Pound has a lower portfolio variances than the exchange rate variances of the individual currencies in that cocktail. This paper is to re-examine and hopefully strengthen A & C’s suggestion concerning the use of portfolio models in the construction of currency cocktails and his suggestions on Markowitz Portfolio Theory are delineated. G. A. Pogue, December 1970: Since time, many extensions to Markowitz basic approach have been suggested by various authors attempting to explain the asset-holding behaviour of individuals or develop normative rules for asset choice. There are a set of assumptions about the securities markets continually reappearing. Current Portfolio selection models generally ignore the brokerage fees involved in revising an existing portfolio. Secondly, it is assumed that assets are perfectly liquid, that is, convertible without delay into currency at full market value in any quantity. Thirdly, there is a question on taxes on portfolio capital gains and dividend income. The purpose of this paper is to consider a number of these generally neglected issues. The Markowitz model will be extended to include the investors expectation

regarding the two components of portfolio transactions costs- brokerage charges and price effects associated with large volume transactions. The model also includes short sale and liability alternatives, as well as a treatment on the tax problem. Marc C. Steinbach, 2001: Mean- variance portfolio analysis provided the first quantitative treatment of the trade-off between profit and risk. We described in detail the interplay between objective and constraints in a number of single-period variants, including semi variance models. Particular emphasis is laid on avoiding the penalization of over performance. the result are then used as building blocks in the development and theoretical analysis of multiperiod models based on scenario trees. A key property is the possibility of removing surplus money in future decisions, yielding approximate downside risk minimization. Gordon J Alexander, July-september 2009: Harry Markowitz is often referred to as the ‘ founder of Modern portfolio theory’ and deservedly so given his enormous influence on the money management industry. However, it is my contention that he should also be referred the basis for how risk is currently viewed through the lens of statistics where the probability distribution of its rate of return is evaluated in terms of its expected value and statndard deviation. Since the ultimate selection of a portfolio of securities should be viewed through the lens of statistics where the probability distribution of its rate of return is evaluated in terms of its expected value and standard deviation. Since the ultimate selection represents the brith of modern risk management whereby risk is quantified and controlled. In thois paper, the author first introduces value at risk as a measure of risk and how it relates to standard deviation, the risk measure at the heart of the model of Markowitz. Secondly,

the conditional value at risk as a measure of risk and compare it with VAR and finally introduce the stress testing as a supplemental means of controlling risk. Daniel Linzmeier, May 3 2011: This paper examines the difference between three risk balanced portfolio construction strategies. Based on the low volatility anomaly introduced by Haugen & Baker (1991), minimizing portfolio variance, maximising diversification have been proposed as alternative portfolio construction approaches. Also, it looks at the idea to equalize total risk contribution. The paper presents a detailed analysis of three risk balanced portfolio construction approaches, namely minimum variance, maximum diversification and equal risk contribution. Finally, empirical tests using a broad European stock universe. Finally, all risk balanced portfolio construction methodologies have in common that focusing on assets with low volatility to reduce risk of the resultant portfolio is tantamount to build up momentum exposure, whereas the minimum variance approach exhibits superior reduction of total risk. Duncan M. Holtausen, March 1981, Two attribute risk and return models are very popular in the economics and finance literature for analysing decesions under uncertainity. Their popularity stems primarily from the intuitive appeal of the dichotomy into risk and return, and from the ease with which the concepts can be diagrammed in two dimesnions. The paper talks about the shortcomings of the widely known mean — variance model that’s is: 1) mean variance dominance is neither necessary nor sufficient for second degree stochastic domianance. 2)unless the form of the probability distribution is restricted, mean-varaince is consistent with von Neumann — Morgenstern utility theory (only if the utilty function is quadratic). Risk is associated only

with below-target outcomes and return is measured only by above — target outcomes. The major result is that the Î±-Î²-t model is consistent with first, second and third degree stochastic dominance for appropriate values of Î± & Î². Haim Levy and Paul A. Samuelson, November 1992: This paper extends the CAPM risk —return relation to the case where expected utility is defined on terminal wealth under heterogeneous investment holdings periods. Investors are allowed to revise their portfolios every period during their finite time horizon, but each investor may differ with respect to the numbers of single periods in their overall holding periods. The paper also analyses the relationship between multi-period investment decisions making the single period equilibrium prices. George M. frankfurter, Herbert E. Phillips and John P. Seagle, 1976: The paper discusses both Sharpe Portfolio and the Markowitz selection approaches for portfolio selection in an analytical process. The properties of these analytical processes are examined I the same sense that one studies the properties of a statistical estimator, except that a global view of the analytical process is taken. An experiment is used to compare and contrast the effects of estimation error and possibly model misspecification, on the performance of two analytical processes for portfolio selection. From the experiment it was found out that the Sharpe outperformed the standard Markowitz approach in its ability to discriminate that under conditions of uncertainty, the Sharpe approach has potential advantages over the Markowitz Approach. Zhong-Fei Li, Kai W. Ng, KenSeng Tan, Hailiang Yang (2006): This article gives a variant to the Markowitz mean- variance model. What it does is, it includes the Earnings at Risk measure in portfolio optimization problem. This derived closed-form solutions

to mean-EaR and mean-variance dynamic portfolio optimization problems under the Black-Scholes setting. HaraldLohre, Thorsten Neumann, Thomas Winterfeldt (2007): For constructing a portfolio construction we have to reach a trade of between risk and return. Risk is the variability of return or the return volatility so we examine other methods that account for asymmetrical nature of risk. This article indicates that portfolio optimization technique can reduce the asymmetrical risk when compared to buying and holding the stock till reaching a benchmark. Con Keating, William F. Shadwick (2002): This article introduces a new method for analysing returns distributions, the Omega function. This can be used as a natural performance measure. This article also describes how this can be applied across various problems relating to financial analysis. Haim Levy, Enrico De Giorgi, Thorsten Hens (2003): Markowitz and Sharpe won the Nobel Prize for the development of Mean-Variance analysis and the Capital Asset Pricing Model (CAPM). Later Kahneman won the Nobel Prize for the development of Prospect Theory. Kahneman put forward his Prospective Theory as an alternative to Shapre’s Expected Utility (EU) theory. This article studies whether these different theories co exist. N. Ren, M. Zargham, S. Rahimi (2006): Earlier stock selection rules where used to construct portfolio performance, But in the current scenario these guidelines where not efficient for the current stock market. This article uses Decision Tree Classification method was used for stock prediction. The result shows that Decision Tree Classification method gave good performance. The rules made are capable of selecting securities with high return and also constructing an optimum portfolio. Research Methodology For constructing the portfolio in this project we have selected

companies from both Large Cap companies and Mid Cap companies. From each sector eight companies are selected, so a total of sixteen companies. The companies are selected based on their market capitalization. Companies with the largest market capitalization in each sector are selected. Companies selected under each both the Market Caps are: Large Cap Companies: Reliance Industries Limited (RIL), Coal India Limited (CIL), Oil & Natural Gas Corporation Limited (ONGC), Tata Consultancy Services (TCS), ITC Limited (ITC), BharatiAirtel (Airtel), NTPC Limited (NTPC) and State Bank of India (SBI). Mid Cap Companies: Federal Bank Limited, Glaxosmith Kline Consumer Healthcare Limited (GSKCONS), Tata Chemicals, United Phosphorus Limited (UNIPHOS), Bajaj Holdings, Glenmark Pharmaceuticals Limited (GLENMARK), 3M India, Jain Irrigations Systems Limited. The data of the previous five financial year are used for the constructing the portfolio; ie, from 01-April-2006 to 31-March-2011. The data is obtained from the NSE India's website. The steps in constructing the portfolio using the Sharpe Method are as follows i. Find the excess return to Î² ratio = Ri-RfÎ² ii. Arrange the calculated excess return to Î² ration in the descending order. iii. Find the cut-off point Cut-off Point: Ci= 62áµ�i= 1nRi-RfÎ²Ïƒ2ei1+62áµ�i= 1nÎ²2Ïƒ2ei iv. Decide how much to be invested in each security. Xi= Zii= 1nZi Where, Zi= Î²Ïƒ2ei(Ri-RfÎ²+C*) All the calculations are done in Microsoft Excel. Analysis and Interpretation The return of individual securities and also market return is calculated. The standard deviation, Î², Correlation, 6²áµ and 6²ei are also calculated. The highest Î² is for Reliance Industries Limited. Using these values and the Risk Free rate of return (10. 5%) we have calculated the excess rate of returns and the securities are ranked in the descending order

based on the excess rate of return. Securities | Ri | Î² | Rf | (Ri-Rf)/Î² | Ranking | Reliance | 88. 08296 | 1. 159833296 | 10. 5 | 66. 891 | 9 | Coal India | 3. 13330 | 0. 239891059 | | -30. 709 | 15 | ONGC | -39. 23967 | 0. 911617383 | | -54. 562 | 16 | TCS | 29. 39869 | 0. 85327325 | | 22. 148 | 13 | ITC | 39. 77428 | 0. 653765653 | | 44. 778 | 12 | BharatiAirtel | 59. 02338 | 0. 87468021 | | 55. 476 | 10 | NTPC | 68. 27773 | 0. 813541938 | | 71. 020 | 8 | SBI | 149. 77548 | 1. 059409659 | | 131. 465 | 5 | Federal Bank | 120. 31992 | 0. 798666117 | | 137. 504 | 4 | Glaxo Smith (Health Care) | 152. 11099 | 0. 358082515 | | 395. 470 | 1 | Tata Chemicals | 72. 74709 | 0. 867249053 | | 71. 775 | 7 | United Phosphates | 19. 76475 | 0. 730442566 | | 12. 684 | 14 | Bajaj Holdings | 38. 18807 | 0. 60326308 | | 45. 897 | 11 | Glen Mark Pharma | 86. 29062 | 0. 797242028 | | 95. 066 | 6 | 3M India | 116. 45961 | 0. 428882171 | | 247. 060 | 2 | Jain Irrigation | 98. 84399 | 0. 56867036 | | 155. 352 | 3 | Large Cap Companies | Mid Cap Companies | After ranking the securities the cut-off point is calculated. The cut-off point obtained is 115. 95 (given below) Rank | Securities | Ri | Î² | Rf | 6²ei | (Ri-Rf)Î²/6²ei | âˆ‘(Ri-Rf)Î²/6²ei | 6²áµ*(âˆ‘(Ri-Rf)Î²/6²ei) | Î²²/6²ei | âˆ‘ Î²²/6²ei | 1+6²áµâˆ‘ Î²²/6²ei | Ci | 1 | GSKCONS | 152. 11099 | 0. 3581 | 10. 5 | 4. 841488709 | 10. 47372497 | 3. 498520878 | 43. 66428642 | 0. 026484227 | 0. 026484227 | 1. 330543944 | 32. 81686908 | 2 | 3M India | 116. 45961 | 0. 428882171 | | 6. 207673627 | 7. 320647266 | 10. 81916814 | 135. 03171 | 0. 029631055 | 0. 056115282 | 1. 700362763 | 79. 41347161 | 3 | Jain Irrigation | 98. 84399 | 0. 56867036 | | 14. 56454585 | 3. 449377088 | 14. 26854523 | 178. 0826434 | 0. 022203643 | 0. 078318925 | 1. 977481656 | 90. 05526947 | 4 | Federal Bank | 120. 31992 | 0. 798666117 | | 7. 696214583 | 11. 39644021 | 25.

66498544 | 320. 3191619 | 0. 082880689 | 0. 161199614 | 3. 011897702 | 106. 3512754 | 5 | SBI | 149. 77548 | 1. 059409659 | | 7. 522094143 | 19. 61551962 | 45. 28050506 | 565. 1362423 | 0. 149206963 | 0. 310406577 | 4. 874117712 | 115. 9463673 | 6 | Glenmark Pharmaceuticals | 86. 29062 | 0. 797242028 | | 14. 74517327 | 4. 097847367 | 49. 37835243 | 616. 2805937 | 0. 043105282 | 0. 353511859 | 5. 412105462 | 113. 8707658 | 7 | Tata chemicals | 72. 74709 | 0. 867249053 | | 7. 974365293 | 6. 769658451 | 56. 14801088 | 700. 7712444 | 0. 09431734 | 0. 447829199 | 6. 589259886 | 106. 3505244 | 8 | NTPC | 68. 27773 | 0. 739923861 | | 5. 298756928 | 8. 068142162 | 64. 21615304 | 801. 467991 | 0. 103323728 | 0. 551152927 | 7. 878821108 | 101. 7243544 | 9 | Reliance | 88. 08296 | 1. 159833296 | | 9. 19513642 | 9. 785967012 | 74. 00212006 | 923. 60454 | 0. 146296174 | 0. 6974491 | 9. 704712176 | 95. 17072976 | 10 | BharathiAirtel | 59. 02338 | 0. 87468021 | | 9. 168024743 | 4. 629398531 | 78. 63151859 | 981. 3830671 | 0. 083449324 | 0. 780898425 | 10. 74622524 | 91. 32351548 | 11 | Bajaj Holdings | 38. 18807 | 0. 60326308 | | 9. 615167974 | 1. 737170644 | 80. 36868923 | 1003. 06432 | 0. 037849193 | 0. 818747617 | 11. 21861287 | 89. 41072589 | 12 | ITC | 39. 77428 | 0. 653765653 | | 6. 737993855 | 2. 840388566 | 83. 2090778 | 1038. 514599 | 0. 063432757 | 0. 882180375 | 12. 01030347 | 86. 46863934 | 13 | TCS | 29. 39869 | 0. 85327325 | | 10. 56001698 | 1. 527056917 | 84. 73613471 | 1057. 573468 | 0. 068946408 | 0. 951126783 | 12. 87080875 | 82. 16837714 | 14 | United Phosphates | 19. 76475 | 0. 730442566 | | 11. 77704565 | 0. 574623429 | 85. 31075814 | 1064. 745219 | 0. 045303921 | 0. 996430703 | 13. 43623724 | 79. 24430032 | 15 | Coal India | 3. 13330 | 0. 239891059 | | 4. 072188896 | -0. 433969166 |

84. 87678898 | 1059. 328943 | 0. 014131889 | 1. 010562592 | 13. 6126143 | 77. 8196546 | 16 | ONGC | -39. 23967 | 0. 911617383 | | 11. 51722207 | -3. 937021577 | 80. 9397674 | 1010. 191824 | 0. 072156831 | 1. 082719423 | 14. 51318819 | 69. 60509369 | Ï²áµ• | 12. 48078487 | | Five securities are selected for investment. These include the four companies immediately above the cut-off point and the company which gives the cut-off point. The proportion of money to be invested in these five securities is found out using Xi (%). Company Name | Î²/6²ei | ((Ri-Rf)/Î²)-C* | Zi | Xi (%) | GSKCONS | 0. 073961241 | 362. 6534169 | 26. 82229692 | 57. 84052216 | 3M India | 0. 069089034 | 167. 646491 | 11. 58253403 | 24. 97697413 | Jain Irrigation | 0. 03904484 | 65. 29658312 | 2. 549494627 | 5. 497817764 | Federal Bank | 0. 103773889 | 31. 15289332 | 3. 232856888 | 6. 971443608 | SBI | 0. 140839723 | 15. 51880824 | 2. 185664661 | 4. 713242331 | Findings From the analysis we have found out the portfolio constructed from the sixteen companies selected, The portfolio consist of five companies, they areGlaxosmithKline Consumer Healthcare Limited, 3M India, Jain Irrigation Systems Limited, Federal Bank Limited and State Bank of India. The percentage of money to be invested in each security has also been found out. Out of these five stocks selected only State Bank of India consists from the Large Cap segment. Recommendations Based on the calculation and the analysis it has been found out that the portfolio can be constructed from the five securities selected. The proportion of money to be invested in each of the securities is also found out. The percentage wise break up is given below Companies | Percentage | GlaxosmithKline Consumer Health Care | 58% | 3M India | 25% | Jain Irrigations | 5% | Federal Bank | 7% | State Bank of India |

5% | | | Conclusions The optimum portfolio is constructed using Sharpe method. The proportions of money in which the securities have to be invested in these securities are also calculated. The final decision of investing should be made only after considering all the factors affecting the securities. Bibliography * NSE website: http://www. nseindia. com * R Stanfford Johnson and Richard A Zuber, 2011: “ The construction of International currency cocktails- An argument for the use of the Markowitz portfolio Model" * G. A. Pogue, December 1970: “ An extension of the Markowitz Portfolio selection model to include variable transactions costs, short sales, leverage policies and taxes" * Marc C. Steinbach, 2001: “ Markowitz Revisited: Mean Variance models in financial Portfolio Analysis" * Gordon J Alexander, July-september 2009: “ From Markowitz to modern management" * Daniel Linzmeier, May 3 2011: “ Risk Balanced Portfolio Construction" * Duncan M. Holtausen, March 1981: “ A Risk- Return Model with Risk and Return Measured as Deviations from a Target Return" * Haim Levy and Paul A. Samuelson, November 1992: " The Capital Asset Pricing Model with Diverse Holding Periods" * George M. frankfurter, Herbert E. Phillips and John P. Seagle: “ Performance of the Sharpe portfolio selection model: a comparison" * Daniel Linzmeier (2011), Risk Balanced Portfolio Construction * Haim Levy, Enrico De Giorgi, Thorsten Hens, 2003: Two Paradigms and Nobel Prizes in Economics: A Contradiction or Coexistence? * N. Ren, M. Zargham, S. Rahimi (2006), A Decision Tree-Based Classification Approach to Rule Extraction for Security Analysis * Zhong-Fei Li, Kai W. Ng, Ken Seng Tan, Hailiang Yang (2006), Optimal Constant-Rebalanced Portfolio Investment Strategies For Dynamic Portfolio Selection * HaraldLohre,

Thorsten Neumann, Thomas Winterfeldt, 2007: Portfolio Construction with Downside Risk * Con Keating, William F. Shadwick, 2002: A Universal Performance Measure * Joanne M. Hill, 1900: Reducing Forecast Error in Portfolio Management: Sample Clustering and Alternative Risk Specifications * George M. Frankfurter, Herbert E. Phillips, John P. Seagle, 1976, Performance Of The Sharpe Portfolio Selection Model: A Comparison * J. P. Dickinson, 1974: The Reliability Of Estimation Procedures In Portfolio Analysis