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RESEARCH ARTICLE

A STUDY ON APPLICATION OF QUANTITAVE FINANCE

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ABSTRACT

Quantitative finance is emerging from the markets very recently as an off lately solution for the problem of deciding the investment choice based on the past returns by taking into the account various factors like risk-free rate, average annualized index returns. This is a very systematic and factual process of choosing investment vehicles as compared to just past price comparisons which measures only the past rate of investment returns. In a dynamic and complex market, we have to keep in mind the obsolescence of a technique is at a faster rate than coming up with new analyzing techniques. Keeping updated investment decisions is a foremost priority. Earlier investors only used the past return of investment and jump into the investment based on the belief that the same investment will yield the same returns or above if favorable conditions prevailed. This lead to the effect of the bandwagon effect. And later when the prices on their investment fell they eventually lose their money. The decision of investment was made on the lacked factual and evidential data which causes havoc on their personal finances. To cope up with the uncertainties these two ratio's came into the picture as their savior i.e. capital asset pricing model and Sharpe ratio. The research focuses on the capital asset pricing model and Sharpe ratio as instruments for analyzing. These two ratios are a relatively newer concept of analyzing investment opportunities. It undertakes all other factors that are likely to affect the investment like the market forces, influence government agencies and Resave Bank of India, these parameters proves a point with conformity of rational techniques of the aforesaid ratios. Offering better flexibility for comparison between two asset classes ranging from debt, equity or hybrid types of investments. A way to make wise investment decision in the market and attain investor's objectives

INTRODUCTION

Quantitate finance is popularly known as financial engineering. It is an interdisciplinary field in which primarily functions on mathematical finance, numerical methods and computer simulations (algorithms and sophisticated models) to make trading, hedging and investment decisions and actions systematic as possible. It also helps in determining effective risk management strategies to apply and implement to minimize the chances of incurring losses in the financial markets. Practitioners of quantitative finance aim to accurately determine the financial risk that certain financial instruments cause in the course of an unforeseen even the markets. Common examples include the pricing of derivative securities such as options and risk management as it relates to portfolio management applications (mutual funds and hedge funds). Professionals who work in quantitative finance are often referred to as "Quants." Quantitative finance began in 1900 with Louis Bachelier's doctoral thesis Theory of Speculation, which provided a model to price options under a Normal Distribution. (Bachelier's, 1900).

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Harry Markowitz's 1952 doctoral thesis "Portfolio Selection" was one of the first efforts in economics journals to formally adapt mathematical concepts to finance. He formalized a notion of mean return and covariance's for common stocks which gave him to introduce the concept of diversification in a market (Markovitz, 1952). Fischer Black and Myron Scholes had developed the Black–Scholes model, which was awarded by the 1997 Nobel Memorial Prize in Economic Sciences. It provided a solution to a practical problem. It was for finding a fair price for a European call option, i.e., the right to buy one share of a given stock at a specified price and time. Such options are frequently purchased by investors as a risk-hedging device (Fischer & Myron, 1973). The types of Quantitative finance are Risk Management Quants, Algorithmic Trading Quants, Front office quant, Investment/assets management Quants.

LITERATURE REVIEW

The capital asset pricing model: theory and evidence by Eugene F. Fama and Kenneth R. French was published in the Journal of Economic Perspectives—Volume 18, Number 3—summer 2004. The study aims to capture that the capital asset pricing model can be used not only for assessing the financial

market and securities but also other aspects such as the real estate market, consumer durables and, human capital. This model should expand beyond the financial products was the main objective of this paper (Fama & French, 2004). X-CAPM: An extrapolative capital asset pricing model by Nicholas Barberis, Robin Greenwood, Lawrence Jin Andrei Shleifer which was published in the Journal of Financial Economics 2015. The study aims to capture that many investors try to invest in the stock market by making vague and hypothetical guesses with getting into the details of the financial statement and technical aspects. They guess the future price stock movement. Keeping in this mind investor's wise and rational decision by applying the capital asset pricing model in determining the expected return which in turn will enable them to gauge the price movement and take calculative risk (Barberis, Greenwood & Shleifer, 2015).

Anchoring Adjusted Capital Asset Pricing Model by Siddiqi Hamid of the University of Queensland was published in the Munich RePEc Personal Archive in the year 2015. The aims to capture that by anchoring the pricing model of the top leading indexes and particular giant stocks. It will enable to determine the overall volatility in the market or for a particular segment. It enables us to set benchmark volatility as a value to enable to judge the volatility for other stocks and indices. It focuses on beta aspects of the capm (Hamid, 2015). Validating the Capital Asset Pricing Model at Irish Stock Exchange by Federica Saporito published in the year 2017 published in the trap paper. The methodology pursued, intending to clarify the linearity and positivity of the risk-return relationship, consists of a linear regression followed by a t-test of the intercept which showed a rejection of the model in all the three sub-periods, as the intercept was non-zero. However, despite the statistically non-significance of the CAPM, it emerged that during the crisis the co-movement risk-return is more evident and positive than in the other sub-periods which is pre and post-crisis. Hence, the results suggest that there is more than one factor which explains the asset returns and that the Capital Asset Pricing Model, itself is not a valid model in helping to predict the asset prices at Irish Stock Exchange (Saporito, 2017). The capital asset pricing model in real estate investment By S Locke was published in the year 1987 was published in the University of Tasmania Eprints Repository. The study aims to capture that like financial investments is assessed similarly the beta for the real estate investments does not apply because of the relatively is fluctuation in the prices of the real estate investments concerning the volatility in the real estate market. (Locke, 1987). Losing money with a high Sharpe ratio was written by valdmirvovk in the year 2011 and was published in the royal Holloway research paper. The study aims to capture that that when investors invest in stocks or any financial instruments for that matter with high shrape ratios exceeding the average values investors tend to lose a lot of money due to a lot of unsystematic risk involved. Hence any investments with a high Sharpe ratio must be held only for a short period and must not be considered as a long term investment (Vovk, 2011). Hedge Fund performance evaluation using the Sharpe and Omega ratios By Francois Van Dyk, Gary van Vuuren and Andre Heymans in the year 2014 was published in The Clute Institute. The study tells us that the Sharpe ratio is susceptible to manipulations and window dressing, which as a result omega ratio helps us to understand the impact of the manipulated values. He states that Sharpe ratio must not be used as a single entity for performance metrics but along with its omega ratio must also be used (Dyk & Vuuren, 2014). A Sharpe-ratio-based measure for currencies By Javier Prado-Dominguez and Carlos Fernández-Herráiz in the year 2015 was published in Europa Grande. The study aim to capture how the Sharpe ratio can be also applied to the foreign exchange market to assess the financial risk involved. The papers aims to tell us that the Sharpe ratio is a multi-diverse concept where it can be applied to all instruments involving monetary value. (Dominguez & Herráiz, 2015). Sharpe Ratio Maximization and Expected Utility when Asset Prices have Jumps was written by Morten Christensen and Eckhard Platen in the year 2009 was published by the research paper of economics. The study aims to capture that Sharpe ratio must not be considered when there is sudden movement of prices in the market caused by the external factors as it leads to taking of a false investment decision because the price movement is temporary in nature caused by the market participants and the intermediaries and not a result of genuine fundamental data of an underlying asset. (Christensen and Platen, 2009). Time-Varying Sharpe Ratios and Market Timing was written by Robert F. Whitelaw in the year 1997 was published by D-space New York University. Pre-determined financial variables are used to estimate both the conditional mean and volatility of equity returns, and these moments are combined to estimate the conditional Sharpe ratio. (Whitelaw, 1997).

Concept

Sharpe Ratio

What Is the Sharpe Ratio?: The Sharpe ratio was developed by Nobel laureate William F. Sharpe it is used to help investors understand the return of an investment in comparison to its risk the investors undertake. The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Subtracting the risk-free rate from the mean return allows an investor to better isolate the profits associated with risk-taking activities. Generally, the greater the value of the Sharpe ratio, the more attractive the risk-adjusted return. Standard deviation measures how spread out the numbers are from the average value it can be calculated by taking the square root of the variance which itself is the average of the squared difference of mean. Mutual fund and hedge fund analyst look for standard deviation for measuring risk. By taking the standard deviation of portfolio annual rate of return analyst can measure the consistency with which returns can be generated.

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$$

R_p = Return of portfolio

R_f = Risk-Free rate

σ_p = Standard deviation of portfolio's excess return

Capital Asset Pricing Model

The capital asset pricing model (CAPM) is a model used to determine a theoretical or hypothetical required return from an asset, to make decisions whether to add a particular financial asset(stocks and bond) in the portfolio to make it equally well diversified in avoid the concept of risk. The CAPM model is a model for pricing an individual security or portfolio. For individual securities, we make use of the security market line and its relation to expected return and systematic risk (beta) to show how the market must price individual securities in to with their security risk class.

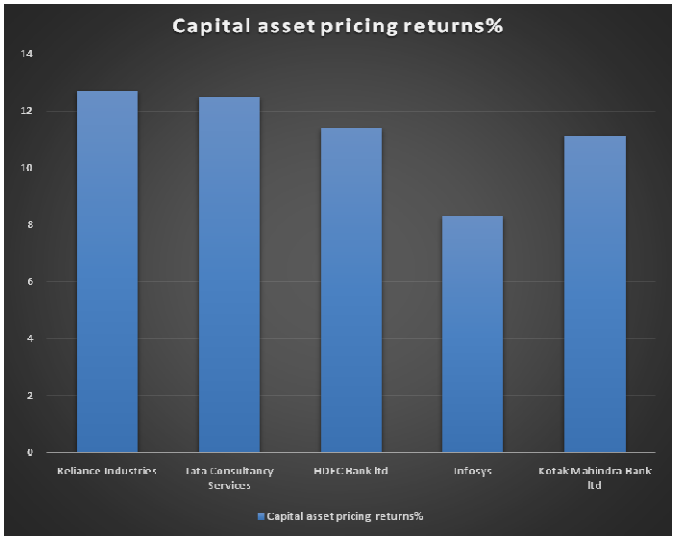
Application of Research

PARTICULARS	VALUES	VALUES	VALUES	VALUES	VALUES
Name of the company	Reliance industries	Tata consultancy service ltd.	HDFC Bank ltd	Infosys ltd	Kotak Mahindra Bank ltd
Market capitalization	7,35,861.Cr	837,543.8 Cr.	1,217,161.8 .Cr	344,890.4 .Cr	277,016.6 .Cr
Basic EPS	66.80	83.93	78.7	35.4	37.8
Current market price	1241.75	2233.45	2226.45	806.95	1450.85
Expected Return required on financial asset	10%	10%	10%	10%	10%
Risk free rate of return	6.54%(10-year govt. bond yield)	6.54%(10-year govt. bond yield)	6.54%(10-year govt. bond yield)	6.54%(10-year govt. bond yield)	6.54%(10-year govt. bond yield)
Beta value of the financial securities	1.09	1.05	0.855	0.314	0.813
Average return on capital market	12.2%	12.2%	12.2%	12.2%	12.2%

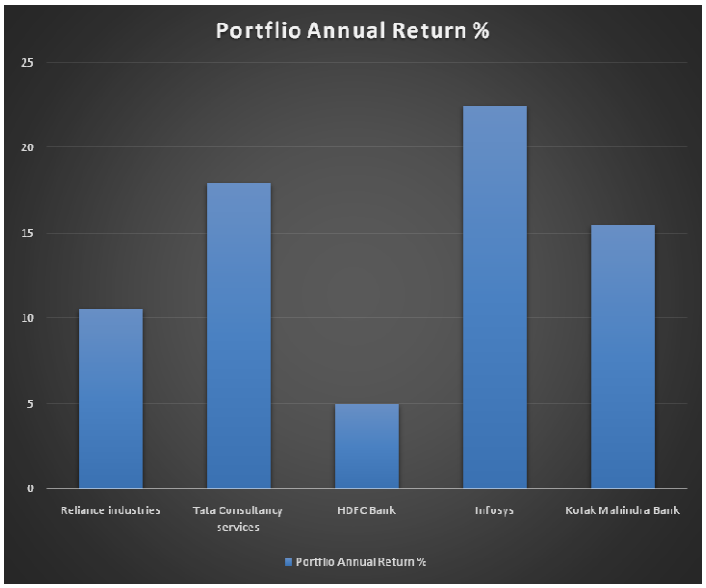
Source: money control, trendlyne, and NSE.

Computation: Sharpe ratio

Securities	Portfolio Annual Returns	
Reliance industries	10.57%	Standard Deviation, σ: 0.06043. Count, N:5
Tata consultancy services	17.98%	Sum, Σx:0.7144 Mean, μ:0.14288 Risk-free rate: 6.54%
HDFC Bank	4.96%	
Infosys	22.46%	
Kotak Mahindra Bank	15.47%	
	Mean = 14.28%	



Source: Primary data



The SML enables us to calculate the reward-to-risk ratio for any security concerning to that of the overall market. When the expected rate of return for any security is deflated by its beta coefficient, the reward-to-risk ratio for that security is equal to the market reward-to-risk ratio. The market reward-to-risk ratio is effectively the market risk premium and by rearranging the above equation and solving for E(ri) we obtain the capital asset pricing model (CAPM).

$$E(r_i) = R_f + \beta_i(E(r_m) - R_f)$$

$E(r_i)$ = return required on financial asset i
R_f = risk-free rate of return
β_i = beta value for financial asset i
$E(r_m)$ = average return on the capital market

Objectives of the research: The objective of the research is to apply the capital asset pricing model and the Sharpe ratio i.e. the determinants of the quantitative finance; on indices of the Indian stock market and the various prominent securities of the indices. To check the level of reliability and the outcome of the investment whether positive or negative returns on the capital.

Statement of the Problem: Novice investors are making irrational investment decisions based on short term price movements. In order to curb this practice; a rather scientific procedure is to apply the Capital asset pricing model and Sharpe ratio. To enhance their decisive actions to yield returns better than average.

RESEARCH METHODOLOGY

The research is being conducted on the basis of data obtained from secondary sources i.e. secondary data. The prominent sources of the information derived from various sites like money control, Bloomberg and morning star. The data obtained from these sources are mainly price-related because the application of our research process is such that it mainly deals with price information based upon which investment decisions are taken. The prices are derived from these sites are directly provided by the stock exchange. The subjects of the research are primarily focused on the national stocks exchange index NIFTY 50, and its member constituents which are Tata consultancy services, reliance industry, HDFC Bank, Infosys, and Kotak Mahindra Bank. The underlying securities are chosen on the. Basis of the market capitalization. These securities have increased weight in terms of their values. The risk-free rate assumed for the purpose research is the India-10 year government yield which is 6.54% as of 29th August 2019. The beta values are obtained from the respective stocks from published web pages indicating performance. Average return from the indices i.e. nifty 50 accounts to 12.2% average annualized returns. Standard deviation is applied to respective stocks with conformity to the formulas of the aforesaid. The expected rate of return of investment from the investment accounts to 10% i.e. taking into the consideration of bank rate interest 7%. Reason justified because of the risk of an investment undertaken depicted by the beta values. This information are being calculated based in the data obtained from the tabulation. The capital asset pricing model is applied to individual stocks and the Sharpe ratio is applied to the above selected-stocks as in the form of a portfolio. The stocks are being compared to their indices with regards to the rate of return from year to date format.

Findings and analysis: The from data given above with regards to the capital asset pricing model, we find that Reliance industries have the highest capital asset pricing percentage i.e. 12.709% indicating greater returns. Followed by the Tata consultancy services having a percentage of 12.438%. Thereby giving a tight investment opportunity to reliance. The second level of securities; in terms of returns is Kotak Mahindra Bank and HDFC bank giving a returns percentage of 11.379% and 11.141% shoes us the second grade of investment opportunities. Showing that they are the second most preferable investments yield good returns but not as exemplified as the first class. the last class in terms of suitable investment is Infosys yielding capital asset pricing returns of 8.317% indicating that it must be avoided at all cost as this will enable the investor to meet his expectation of attaining higher returns on investment. A Sharpe ratio of above 1.2 is generally considered a good portfolio, as it indicates whether the investor will be able to generate enough returns on investments. In our case, the Sharpe ratio comes up to 1.28 which is a good indication that the set of securities selected by the investor in a portfolio is of good grade investments.

Conclusion

The capital asset pricing model and the Sharpe ratio gives us a definitive investment approach in terms of price and yield factors. It gives us a unique niche when comes to other novice investors. By selecting only those investment opportunities that yield us handful returns on our investment. By applying the aforesaid techniques investor can confidently expect to do better in the stock market or any other investment vehicles for that matter.

Limitations of the study: The study of the capital asset pricing model was completely related to the pricing movements of the market. We take only into account the returns on the market price movements and the risk-free rate. We do not take into account the fundamentals and technical aspects of the company. Fundamental of the company includes revenue, expenses, and assets. Technical aspects include Moving average convergence and divergence, average directional index and simple moving averages. Only price is being determined as a major part of investment decision which makes it hard to assess factual information of the company. Many times scams across various companies take place due to window dressing of the accounting books leading to manipulation. When the curtains are unveiled forces investors to lose on their investments as their investment decision was purely based on the price movements and not on the facts and figures of the company. Popular examples include Sathyam computers and Kingfisher airlines. These ratios ignore the business cycles by taking only the information of facts and ignoring the causes. An investment opportunity may seem attractive because of the favorable ratio, but the industry might have reached its pinnacle of growth and decline stage might have just begun. It excludes all the qualitative information regarding the company. It does take into consideration the director's report and independent audited report Important qualitative aspects are to be disclosed.

Further scope of the study: The study of finance is never an end to itself, it can be extended beyond measure. Instead of taking the risk-free rate as the government 10-year bond yield.

They can take the average fixed deposit rate offered by the commercial banks, this would offer competitiveness between investment opportunities especially during the growth phase of the business cycle in any industry. The theory focuses on investing in those companies that yield better returns. But instead of doing that, the investor can invest in those that have returns that below the best one like in our case either HDFC bank or Kotak Bank. Because they still have opportunities that might lead to increased growth rates compared to investing in those that have used all of their opportunities to grow. Which might not lead to better a return in the next financial year. The company should focus on the market capitalization aspect. Generally greater the market capitalization chances of growing terms of percentage is less because the percentage of movement is great in term of quantum of funds. If the investor invests in companies with lower market capitalization chances, are the returns on which make will be substantial. Predicting the future of an investment vehicle is something that all investors yearn for. There for to come up amendment of the formals to enhance predictability.

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