Risk and Return are topics which stimulated the imagination of academicians for decades.After the development of portfolio theory,once risk diversification is accompalished,the concept of the market risk and betas have enabled the academic community to estimate the parameters of risk and return.In this context the authors have applied the CAPM study for India .The study covers five companies listed on the National Stock Exchange of India (NSE). These companies are the State Bank of India, Tata Motors, and Reliance group of Companies, Infosystch and HFDC bank.Monthly data for 2005 to 2009 period are collected and analyszed .After giving an excellent theoretical exposition of the CAPM theory,the authors estimate econometrically the risk and return paramters.Finally, the authors contribute to the ongoing discussion on why the equity risk premiums have been recently higher than the historical averages.

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Paul, Asarebea

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CONTENTS

PREFACE

The first draft of this work " Risk modeling and a study of CAPM for major Indian companies " originated in an MBA dissertation by Ms. Fosuhene Akua Asarebea under my supervision at the Faculty of Economics and Administrative Sciences, European University of Lefke, during 2009-210 academic year ,which subsequently went substantial changes with her permission by me. The commanding importance of the CAPM is still relevant today. Every investment carries two distinct risks ,the CAPM explains. One is the risk of being in the market ,which Sharpe called systematic risk This risk, also named as "beta", can not be diversified away. The other-unsystematic risk-is specific to a company's risks .Since this uncertainty can be diversified away ,Sharpe argued that a portfolio's expected return hinges solely on its beta-its relationship to the overall market. The CAPM helps measure portfolio risk and the return an investor can expect for taking that risk. But Fama and French (1996) argued that apart from the market risk ,size factor(small versus big size companies), and value factor(value-higher book value to market value ratio- versus growth stocks-lower book value to market value ratio) also are also important in the determination of the expected returns .But Sharp replies forcefully that those additional factors can at best determine conditional means of expected returns in the short run and not the unconditional expected returns in the long run. He further argues that since the publication of the studies on those effects, they have started disappearing! Well, this is a matter for empirical verification. Apart from the estimation of

the "beta" or the market risk, intercept term (α) would be employed to find out if the company is receiving returns from non-systematic risk or company's specific risk. The regression would determine the returns in excess of the risk-free rate for both the stock and the market. The Jensen's alpha would also be applied to the stocks to determine the average return each stock is receiving over the above what is being estimated by the CAPM. The significance those excess returns each stock is receiving (after market risk has been calculated) would be determined Finally, the question of the actual versus the expected returns of the stocks ,is also important . Fama and French (2002) argued that there has been a decline in the conditional expected return which they proxy as the dividend yields and the rate of growth of the dividends ,in the recent periods (1951 to 200) , and contrastingly the actual capital gains from the stocks(percent increase in stock prices) have been very high .

India is India is said to be one of the fastest growing economies in the world , second only to China, though very recently, Indian economy has slowed down considerably.

The five companies are selected from the 10 most active securities listed on the National Stock Exchange of India. These companies were selected to cover some of the most important sectors of the economy. These include Information Technology (Infosystch), Oil and Gas (Reliance Group of Companies), automobile (Tata Motors), and Finance (State Bank of India and HFDC Bank). Monthly data for the period 2005 to 2009 is collected and

analyzed. The period was chosen because it is characterized by high and low values for both the returns on the stock and the market index(S&P CNX) Nifty.

The first chapter gives a broad introduction to the topics in the book ,including the sample selection, the profile of the companies , and the methodology of the study .The literature survey is given in the chapter two.

The Data analysis and interpretations are given tin chapter three. The summary of the findings and the conclusions are given in chapter four. In the end references and the bibliography are given.

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Fiji . 28th June,2012.

CHAPTER ONE

INTRODUCTION

1.1 Background

> *One of the problems, which have plagued those attempting to predict the behaviour of capital markets, is the absence of a body of positive micro-economic theory dealing with risk. Although many useful insights can be obtained from the traditional models of investment under conditions of certainty, the pervasive influence of risk in financial transactions has forced those working in this area to adopt models of price behaviour which are little more than assertions…at present there is no theory describing the manner in which the price of risk results from the basic influences of investor preferences, the physical attributes of capital assets etc.*[1]

This earlier statement by William F. Sharpe was the beginning of the model to ascertain the risk factor in pricing capital assets. This later led to the award of a Nobel Prize in 1990.

1.2 Overview of Study

Every human endeavour we undertake involves risk. Risk may be defined as the expected value of one or more results of one or more future events.[2]For much of human history, risk and survival have gone hand in hand. Prehistoric humans lived short and brutal lives as the search for food and shelter exposed them to physical danger from preying animals

[1] William.F.Sharpe, "Capital Asset Prices: A theory of Market Equilibrium under conditions of Risk" *The Journal of Finance*. No. 3 (1964): 425
[2] http://en.wikipedia.org/wiki/Risk

and poor weather. The risk-taking caveman ended up with food and the risk-averse one starved to death.[3]

Risk is used in many disciplines. In technology and economics, risk is expressed as an expected value that an event will be accompanied by undesirable consequences. In planning, risk is what can happen that will cause a project to fall behind schedule or go over cost. In management, risk is the possibility that outcomes will be different from what we expect. For the purpose of this study we are concerned with economic risk. Investors in general like returns and dislike risk. Generally, it is assumed that high risk projects give high returns, but this is not always the case. Low risk projects may sometimes yield high returns and high risk projects low returns however risk-averse investors would normally grab those projects with low risk and those projects with high returns will go to risk-seeking investors

The extent to which we diversify our investment does not determine the possibility of getting rid of all risk. Investors therefore need a rate of return that compensates them for taking on risk in an investment. In the early stages of corporate finance, investors and researchers attributed higher returns for higher risk. It is only with the development of the Capital Asset Pricing Model that economists were able to quantify risk and the reward for bearing it.

1.3. History of CAPM

The Capital Asset Pricing Model was the work of financial economist William Sharpe, set out in his 1970 book "Portfolio Theory and Capital

[3] http://www.robustdecisions.com/decision-making-tools. Date accessed-21/02/2010.

Markets". The underlying concept of the CAPM is that investors are rewarded for only that portion of risk which is not diversifiable.

The model starts with the idea that an individual investment carries two distinct risks.
The Systematic risk and Unsystematic risk

1.3.1 Risk and the CAPM

William F. Sharpe in the 1960's developed the notion of systematic and unsystematic risk.
Systematic Risk: These are market risks that cannot be diversified away. This risk represents the variations in an asset's value caused by unpredicted economic movements. This is the risk that was later called "beta" Typical examples of such risk is interest rate risks and wars.
Unsystematic risks: This is also known as specific risk "this risk is specific to individual stocks or to a company's fortunes and can be diversified away as an investor increases the number of stocks in his or her portfolio. In more technical terms, it represents the component of a stock's return that is not correlated with general market moves.

Articles by William Sharpe and John Litner introduced concepts of systematic and unsystematic risk associated with portfolio rate of return. They defined risk as variation in portfolio returns, such risk comprise two elements.

1. Systematic risk or variation, which is the co-variation of portfolio rate of return with market rate of return.

2. Unsystematic risk or variation, which is the difference between total portfolio variation and unsystematic variation. Unsystematic variation is therefore variation due to attributes of individual securities.

This implies that reducing variation of portfolio returns by increasing the number of different securities can only reduce the unsystematic component.

Harry Markowitz's contribution to Modern portfolio theory shows that specific risk can be removed through diversification.[4] However, diversification does not solve the problem of systematic risks: even a portfolio of all the shares in the stock market cannot eliminate this risk. Therefore when calculating a deserved return, systematic risk is what plagues investors most. Sharpe figured out that a portfolio's expected returns hinges solely on its beta relationship to the overall market. The CAPM helps measure portfolio risk and the return an investor can expect for taking that risk.

1.3.2 Returns and the CAPM

CAPM describes returns on an asset as follows. First, the expected returns on an asset must be at least the return to a risk-free rate. The rationale behind this is that, any risky asset must produce expected returns at least as much as one without risk or there would be no incentive for anyone to hold the risky asset.

Secondly, since unsystematic can easily be diversified away, there is no expected return or compensation inherent in the model for accepting

[4] Markowitz, Harry(1959), Portfolio Selection: Efficient Diversification of Investments .(Wiley, New York)

a risk that is not needed, just because one decides to hold an asset in isolation.

CAPM also models returns by explaining that, the expected returns on assets with systematic risk are expected to be higher than the risk-free rate. This risk cannot be diversified away and must be borne by the investor. Therefore if the systematic risk is non-diversifiable, then the expected returns must be high so that the investor would be willing to accept the risk.

1.4 The Formula of the CAPM model

The standard formula remains the CAPM which describes the relationship between risk and expected returns.

$$E(R_{it}) = R_{ft} + \beta_i (E(M_{rt}) - R_{ft}) + U_t$$

Where R_{it} is the Expected rate of return on the asset

R_{ft} is the risk-free rate of return

$E(M_{rt})$ is the Expected Rate of Return on market portfolio

β_i is the estimate of beta for the stock i.e. the non-diversifiable risk for asset

$(M_{rt} - R_{ft})$ is the risk premium

U_t is the error term

1.4.1 The Risk Free Rate of Return

This is typically a 10-year government bond yield. This is the theoretical rate of return of an asset with Zero risk. The risk-free rate represents the interest rate an investor would expect from an absolutely

risk-free investment over a specified period of time. In theory, the risk free rate of return is the minimum return an investor expects for any investment because he or she will not accept additional risk unless the potential rate of return is greater than the risk-free rate.

In practice however, the risk-free rate does not exist because even the safest investment carry a very small amount of risk. Thus the interest rate of a three-month US Treasury bill is often used as the risk-free rate.

1.4.2 The Beta Factor

A stocks beta factor is the measure of its volatility or systematic risk in terms of market risks. The beta factor of the market as a whole is 1.0. Market risks make market returns volatile and the beta factor is simply a yardstick against which the risk on other investments can be measured. Risk describes a situation where there is not one possible outcome but array of possible returns. Risk is measured as the beta factor or β. The market as a whole has a $\beta = 1$, the Risk free security has a $\beta = 0$, a security with $\beta < 1$ is less risky than average market and vice versa.

1.4.3 The Equity Risk Premium

The Equity risk is defined as the reward that investors require to accept the uncertain outcomes associated with owning equity securities. The equity premium is measured as the extra return that equity holders expect to achieve over risk-free assets on average. To determine an equity premium, one must define a stock market benchmark and a risk-free rate of return. For instance the market can be defined as the S&P CNX Nifty and the risk-free rate defined as Treasury bond or some other risk-free

assets. The equity risk premium is simply the return on the market less the return on the risk-free rate.

1.5 The Objectives of the Study

Every research study has an aim or purpose for which it is being carried out. Over the years various studies have been carried out in support of and against the Capital Asset Pricing Model and numerous conclusions have been drawn. The following are the purposes for which this research is being done.

1. To test the validity of the CAPM in the Indian context. The study would find out whether the risk return relationship of assets according to the CAPM is valid in India. The study would use monthly data of 5 companies stocks and the S&P CNX Nifty as the index for the period 2005 to 2009

2. To test whether the theory should be accepted or rejected. The hypothesis would be tested to set to see if it should be accepted or rejected and then a conclusion would be drawn on whether the model supports the data or not.

3. The study would also provide information that would be useful to investors to help them in making financial decisions. The stocks analysed would provide investors with information on the returns they should expect when they invest in a particular stock. The analysis would evaluate the stocks, assess their relative riskiness and analyse them.

4. The study would also make a comparison among the various stocks to be analysed and conclusions will be drawn.

1.6 The Scope of the Study

The study covers five companies listed on the National Stock Exchange of India (NSE). These companies are the State Bank of India, Tata Motors, and Reliance group of Companies, Infosystch and HFDC bank. Monthly stock prices of these companies from the year 2005 to 2009 would be collected and analysed. Time series data from 2005 to 2009 would be collected to represent the market proxy and then finally Treasury bill rates for the same period 2005 to 2009 would be the risk free rate.

1.7 The Relevance of the Study

The relevance of every research is to make a possible contribution to knowledge, based on that subject matter. Through this research, the performance of these companies can be ascertained and the shareholders' value will also be known. This information would be relevant to potential investors and shareholders who wish to contribute towards the future growth of these companies.

Investors may also use the information in pricing the risk involved in adding any of these stocks to already existing portfolios. Investors would be able to measure the potential risk and return they should anticipate for taking the risk of investing in assets.

The research would also promote spirited debate among interested parties, such as analyst, economists and future researchers who may wish to carry out further studies on the topic.

The National Stock Exchange of India and other stock Exchange market may also rely on the information provided from the research when the need arises.

1.8 Limitations of the Study

1. Financial Constraint: The problem of unavailability of enough funds to undertake the study was one of the limitations to this research work. The amount of money needed to carry out the research was limited.

2. Time Factor: The time available for carrying out the research is confined. There is a stipulated time within which the research must be done. This constraint would prevent any further research which may also be relevant to the work done.

3. Situational Factor: The researcher was not opportune to visit the country and the samples under study to have first-hand data.

4. Sample Size: The sample size was limited to only five companies. This may limit generalisations that would be made from the outcome of the study.

5. Unavailability of Information: The research only made use of publicly available data. Certain vital information which the

samples may not wish to publish but are relevant to the study was unavailable.

The CAPM also has certain limitations which are listed as follows

6. The empirical test of the CAPM has a conceptual problem. The test is based on expected returns of the stock. The expected return is a forward looking expected return concept. Unfortunately in practice, the researcher has to proxy the expected returns from actual past data on the stock. There is the likelihood of bias being introduced in the empirical test

7. The Stability of beta over time is also a limitation to the study. The beta is a measure of the stock's future risk. However there is no future data to estimate the beta. The data is only based on past share prices and the market portfolio. Beta can only be estimated from historical data. The historical data can only be used to measure the future risk if it is stable over time. Most research, has proved that beta of individual securities are not stable over time. This implies that historical betas are poor indicators of the future risk of the stock.

8. The risk-free rate is also far from reality. There is difficulty finding a risk free security. A short term highly liquid government security is used as the risk free rate. There may be the unlikelihood of default by the government, but inflation may cause uncertainty about the real rate of return.

9. The market is a theoretical concept which has to be proxy by the market index returns. This assumes that all investors choose the same composition of risky assets which is far from reality.

1.9 Sample Selection and Data Collection.

The five companies are selected from the 10 most active securities listed on the National Stock Exchange of India. These companies were selected to cover some of the most important sectors of the economy. These include Information Technology (Infosystch), Oil and Gas (Reliance Group of Companies), automobile (Tata Motors), and Finance (State Bank of India and HFDC Bank). Monthly data for the period 2005 to 2009 is collected and analysed. The period was chosen because it is characterised by high and low values for both the returns on the stock and the market index(S&P CNX) Nifty.

Data would be collected from secondary sources. This would be mainly through the internet from website of the National Stock Exchange of India and the Reserve Bank of India. Other sources would be from books, journals, articles and magazines from renowned authors.

1.10 Methodology of the Study

The Sampling design that would be used for the study would be to directly access the monthly stock prices of the five companies and the monthly price of the index from the internet (http://www.yahoofinance.com) and also from the National Stock

Exchange of India website (http:// www.nseindia.com). Monthly wise data on 91 days treasury bill rate from 2005 to 2009 would be used to represent the risk free rate.(Source: The handbook of Statistics on Indian Economy 2002 and Reserve Bank of India Bulletins)

The Simple linear regression analysis would be used in estimating beta or systematic risk of the individual stocks for each company, using the CAPM equation

$$E(R_{it}) = R_{ft} + \beta_i (E(M_{rt}) - R_{ft}) + U_t$$

Beta would be determined to find out the risk or market sensitivity. The statistical test of zero significance of beta would be determined. The hypothesis formulation would be as follows.

$H_{0:} = 0$. The null hypothesis is that the beta is equal to zero or is not statistically significant from zero

$H_1: > 0$ the alternative hypothesis is that the beta is greater than zero.

The performance of each company would then be tested by finding the risk-adjusted performance measure of each stock. The intercept term (α) would be determined to find out if the company is receiving returns from non-systematic risk or company's specific risk. The regression would determine the returns in excess of the risk-free rate for both the stock and the market.

The Jensen's alpha would also be applied to the stocks to determine the average return each stock is receiving over the above what is being estimated by the CAPM. The significance returns each stock is receiving (after market risk has been calculated) would be determined. The single-tailed t-test would be carried out to test the significance of alpha in the CAPM.

The statistical test of zero significance of alpha as explained by the CAPM would be determined. The hypothesis formulation would be as follows.

$H_{0:}$ = 0. The null hypothesis is that the intercept is equal zero to or is not statistically significant from zero

H_1: > 0 the alternative hypothesis is that the intercept is greater than zero.

1.11 Profile of Indian Companies Used In the Study

The Profiles of the five companies used in the study are listed below. The Companies are selected from the active securities listed on the Indian Stock Exchange

1.11.1 The State Bank of India

The State Bank of India traces its ancestry to British India, through the Imperial Bank of India to the founding in 1806 of the Bank of Calcutta making it the oldest commercial bank in the Indian Subcontinent. The government of India nationalised the, Imperial Bank of India in 1955, with the, Reserve Bank of India taking a 60% stake ad renamed it the State Bank of India. In 2008, the Government took over the Stake held by the Reserve Bank of India. The State Bank of India has range of banking products overseas. The State Bank Group with over 16,000 branches has the largest branch network in India. The Bank has an asset base of $250bıllıon and $195bıllıon in deposits. It has a market share among Indian Commercial banks of about 20% in deposits and advances. SBI accounts for almost one-fifth of the nation's loans.[5]

[5] http:en.wikipedia.org/wiki/state_Bank_of_India.

As of May 2008, the bank had 21 subsidiaries and 10,186 branches. SBI was adjourned the best bank in India for 2008 by 'The Banker' Magazine of the Financial Times Ltd. SBI is the only Indian bank the Features in Fortune's top 100 banks. It is also the second largest bank in the world, measured by the number of branches and employee strength. Macroeconomic risk is the biggest risk of SBI, given its size and penetration and exposure in India. Government regulations and country's macroeconomic policies affect SBI's expansion and liquidity the most. Key ratios such as Cash/Reserve Ratio (CRR), Statutory Liquidity Ratio (SLR), Repo Rate and Reserve Repo rate are all controlled by the government and affect the bank's liquidity.[6]

1.11.2 Tata Motors Ltd

Tata Motors Ltd was established in 1945, and is India's largest automobile company. Tata Motors has consolidated revenues of Rs. 70, 938, 55 crores (USD 14 billon) in 2008-2009. It is the leader in Commercial vehicles in and among the top three in passenger vehicles with winning products in the compact size car and utility vehicle segment. The Company is the world's fourth largest truck manufacturer and the world's second largest bus manufacturer. Tata Motors is the first company from India's engineering sector to be listed on the New York Stock Exchange (September 2004) and has emerged as an international automobile company. Tata Motors is expanding its international footprints established through exports since 1961. The Company's commercial and passenger vehicles are already being marketed in several countries in Europe, Africa the Middle East, South East Asia, South Asia

[6] http://www.wikinvest.com/stock/State_Bank_of_India

and South America. The Company also has franchisee/joint venture assembly operations in Kenya, Bangladesh, Ukraine, Russia, Senegal and South Africa.[7]

1.11.3 HFDC Bank Ltd

The Housing Development Finance Corporation Ltd (HDFC) was among the first to receive an approval from the Reserve Bank of India (RBI) to set up a bank in the private sector as part of the RBI's liberalisation of the Indian Banking Industry in 1994. The bank was incorporated in August 1994 in the name of 'HDFC Bank Ltd'. HDFC Bank commenced operations as a scheduled Commercial Bank in January 1995. HDFC is India's premier housing finance company and enjoys an impeccable track record in India as well as in international markets. Since its inception in 1997, the corporation remains the market leader in mortgages. HDFC has experience in the financial markets and has a large shareholder base. Thus, HDFC was ideally positioned to promote a bank in the Indian environment.

As at 31st December 2009, the authorised share capital of the bank was Rs. 550crore. The HDFC group holds 23, 87% of the banks equity and about 16, 94% of the equity is held by the ADS Depository (in respect of the bank's American Depository Shares (ADS) issue. 27, 46% of the equity is held by Foreign Institutional investors. The bank has about 458,683 shareholders. The shares are listed on the National Stock Exchange of India and the Bombay Stock Exchange. The Bank's American Depository Shares (ADS) are listed on the New York Stock

[7] http:// www.tatamotors.com/our_world/profile.php

Exchange (NYSE) under the symbol 'HDB' and the Bank's Depository Receipts (GDR's) are listed on the Luxembourg Stock Exchange.[8]

1.11.4 Reliance Ltd.

The Reliance group was founded by Dhırubhai .H. Ambani (1933-2002) and is India's largest private sector enterprise with businesses in the energy and materials value chain. The flagship company Reliance industries Ltd is a Fortune 500 company and is the largest private sector company in India.[9]The Reliance group started with textiles in the late seventies and integrated vertically into the polyester, fibre, intermediates, plastics, petrochemicals, petroleum refining and oil and gas exploration and production- to be fully integrated along the materials and energy value chain.

Reliance enjoys global leadership in its businesses being listed the largest polyester yarn and fibre producer in the world and among the to five to ten producers in the world in major petrochemical products. The major group companies are Reliance industries Ltd. (including main subsidiary Reliance Retail Ltd) and Reliance Industries Infrastructure Limited.[10] The Reliance Industries Ltd (NSE: RELIANCE) is India's largest private sector conglomerate (by market value) with an annual turnover of US$35,9bıllıon and profit of US$4,85bıllıon for the fiscal year ending in March 2008.The founder Ambanı has been a pioneer in introducing financial instruments like fully convertible debentures to the

[8] http:// www.hdfc.com
[9] Fortune is a global business magazine published by Time Inc's Fortune Money Group. The magazine is especially known for its annual features ranking companies by revenue.
[10] http://www.ril.com-date accessed 15/02/2010

Indian stock markets. He was also one of the entrepreneurs to draw retail investors to the stock market.[11]

1.11.5 Infosys Technologies Ltd

Infosys is India's second largest software company and is recognised globally for its world-class management practices and work ethics. It offers services like software development, maintenance, and consulting, testing and packaging implementation. Infosys offers all these services through its highly integrated and globally recognised delivery model. The company's revenues and profits have grown at compounded rates of 35% each during the period FY03 to FY09. Infosys Technologies Ltd is engaged in Information Technology business. The Company is listed on the National Stock Exchange of India as INFOSYSTCH

The Company was incorporated in 1981.Infosys Technology Ltd is a global technology service firm that defines, designs and delivers Information Technology (IT) enabled business solutions to its clients. The Company provides end-to-end business solutions that leverage technology for its clients, including consulting design, and development.

[11] http:// www.wıkepedıa.org/wıkı/Relıance_Industrıes.date acccesed 10/03/2010

1.12 The Chapter Plan

The book will be planned as follows

Chapter One: This comprises the Introduction, Overview of the Study, The Objectives of the Study, the Scope of the Study, Relevance of Study, Limitations to the Study, Sample Selection and Data Collection, Methodology and Profile of Companies used in the Study

Chapter Two: This is the Literature Review

Chapter Three: This Comprise the Data Analysis and Interpretation

Chapter Four: This is the Summary of Findings and the Conclusion.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction to the literature

The entire "financial economics" theory revolves around an investor who wants to maximize his returns at some given level of risk. To determine the optimal returns at a given level of risk or an optimal risk for a given level of return has been widely discussed in the financial literature consequently raising the issue of asset pricing in financial markets. (Nawazish 2005)[12]

The idea of diversifying a portfolio of stocks to obtain the maximum potential returns given the amount of risk an inventory can take on was established by Harry Markowitz's paper "Portfolio Selection". Markowitz (1952) developed the modern portfolio theory and constructed the mean-variance model. The Markowitz model is based on the assumption that investors care only about the mean and variance returns.

That is why the theory is known as the mean-variance optimizer and therefore seek and prefer portfolio with lowest possible return variance for a given level of mean(expected returns) simply put it implies that investors prefer portfolios that produce greatest amount of wealth with lowest amount of risk. This also suggests that variance-dispersion in possible return outcomes is an appropriate measure of risk.

[12] Mirza Nawazish, The Death of CAPM: A Critical Review (December 6, 2005). The Lahore Journal of Economics, Vol. 10 pp 35 available at SSRN: http://ssrn.com/abstract : 1519405

The optimal portfolio based on the idea between risk and return was the basis of the model. Markowitz found out that there is a positive relationship between risk and return. He proved that investors create their portfolios in order to offer a maximum level of return given a level of risk and a minimum level of return for a given level of risk.

Even though the model of Markowitz was useful in the field of finance, it was criticised as being sophisticated and static.[13]
Tobin (1958) built his theory based on Markowitz proposed idea of Portfolio Selection. Tobin presented his Separation Theorem saying that if an investor holds risky securities and are able to borrow or lend at risk free rate, then the efficient frontier is a single portfolio of risky securities plus borrowing and lending. Such an efficient portfolio dominates any other combination of securities.

Tobin's Separation Theorem, separates the portfolio selection problem into first finding that optimal combination of risky assets and then deciding whether to lend or borrow, depending on investor's preference towards risk.
Tobin further showed that, if there were only one risky portfolio plus lending and borrowing, the optimal portfolio would be the market portfolio.[14]

Twelve years after the work of Markowitz, William. F. Sharpe (1964), John Litner (1965) and Jan Mossin (1965) developed the famous Capital Asset Pricing Model (CAPM). The Capital Asset Pricing Model

[13] Fabozzi F, J.,Gupta, F and Markowitz, H.M 2002, The legacy of Modern Portfolio Theory, Journal of Investing Vol. 11, no. 3, pp 7.
[14] James Tobin, Liquidity preference as behaviour towards risk. Review of Economic Studies, xxv(2) : 65. 1958.

(CAPM) is one of the most important contributors in finance and arguably the most widely used. (Ross Westerfield and Jordan 1996)[15] The CAPM specifies the relationship between financial security returns and risk (defined by the covariance of a security's historical return series with that of a representative risky market proxy). The relationship between risk and return specifies the appropriate market cleaning price. The CAPM specifies that a security's required return has little or nothing to do with company and industry specific events, such as dividend announcement, stock splits etc., these sources of risk are simply immaterial as they are easily diversified away by investors, all of whom are assumed to "rationally" hold Markowitz efficient portfolios.

The CAPM sheds considerable light on the relationship between the price of an asset and the various components of its overall risk. For this reason it warrants consideration as a model of the determination of capital asset prices.[16]

When an investor for example invests in the shares of a company which is listed on a stock market, he expects a risk that the actual returns on the investment will be different from the expected returns. When an investor expects a certain return on an investment he always takes the risk factor into consideration. The CAPM is a method of calculating the return required on an investment, based on the assessment of its risk.

According to Markowitz (1952) diversification enables the investor to escape all but the risk resulting from swings in economic activity- this type of risk remains even in efficient combinations. And since all other

[15] Ross Stephen A; Westerfield, Randolph W and Jordan Bradford D(1996). Essentials of Corporae Finance, Irwin . p. 296.

[16] William F. Sharpe, " Capital Asset Prices: A theory of Market Equilibrium under conditions of Risk". The Journal of Finance No.3 (1964): 427

types can be avoided by diversification, only the responsiveness of an asset's rate of return to the level of economic activity is relevant in accessing its risk.

A "fully diversified" portfolio however cannot get rid of all the risk and thus the risk not diversified away is called the 'undiversifiable risk' or 'systematic risk'. The risk that can be diversified away is called the 'unsystematic risk'. The sum of the systematic and unsystematic risk is the total risk.

The Capital Asset Pricing Model assumes that an investor holds a fully diversified portfolio. This means an investor would want a return on an investment based on its systematic risk alone rather than on its total risk.[17] The measure of risk used in the CAPM is called 'beta'.

2.1.2Assumptions Underlying the Capital Asset Pricing Model

The model is based on certain assumptions. The assumptions and basic conclusions are found in many books and articles that were written by the theories co-developers.[18] The set of assumptions employed to develop CAPM can be summarised as follows.

1. Investors are risk averse, they usually have a preference for expected returns and dislike risk

[17] William F. Sharpe, " Capital Asset Prices: A theory of Market Equilibrium under conditions of Risk". The Journal of Finance No.3 (1964): 428

[18] Conway L. Lackman. Exchange Risk: A capital Asset Pricing Model Framework. Journal of Finance and Strategic decisions. Volume 9 Number 1. 1996

2. Investors make investor decisions based on expected rate of return and the variance of the asset returns i.e. assumptions of two-parameter utility function.

3. Investors desire to hold a portfolio that lies along the efficient frontier.

These three assumptions were made in the development of the Markowıtz and Sharpe single index portfolio analysis model. In addition to these three assumptions, CAPM made the following assumptions.

4. There is a riskless asset and investors can borrow at that risk free rate.

5. All investments are perfectly divisible. That is the traditional shares for any investment can be purchased in any moment.

6. All the investors have the homogeneous expectations regarding investment horizon or holding period and to forecasted expected return and level of risk on securities. At the same time, there is a complete agreement among investors as to the return distribution for each security and portfolio.

7. There are no imperfections in the market that prevent the investors buying or selling the assets. More importantly, there are no commissions or taxes involved with the security transactions. That means, there are no costs involved with the security transactions. That means, there are no costs involved in diversification and there is no differential tax treatment of capital gain and ordinary income.

8. There is no uncertainty about expected inflation, or alternatively, all security prices are fully reflect all changes in future inflation expectations.

9. Capital markets are in equilibrium. That is all the investment decisions have been made and there is no further trading without new information.

Even though, some of the assumptions are clearly unrealistic, since its introduction in early 1960's CAPM has been one of the most challenging topic in financial economics.
The CAPM is a widely tested accepted and rejected model of asset pricing, from its beginning in 1964, it has occupied the prime place in finance.

2.1.3 The Beta Factor in the Capital Asset Pricing Model

Beta is a measure used to compare the systematic risk associated with a company's share with the systematic risk of the capital market as a whole. If the beta value of a company's share is 1, the systematic risk associated with the shares is the same as the systematic risk of the capital market as a whole.

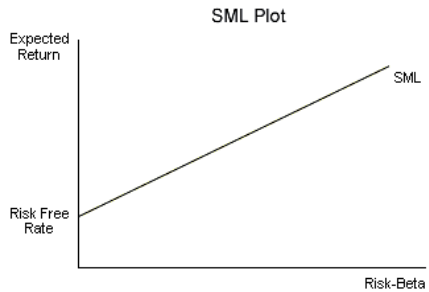
Beta can be described as 'an index of responsiveness of the returns on a company's shares compared to the returns on the market as a whole'. For example if a share has a beta value of 1, the return on the share will

increase by 10% if the return on the capital market as a whole increases by 10%. [19]

2.1.4 The Security Market Line

The Security Market Line is a line that graphs, the systematic or market risk versus return of the whole market at a certain time and shows all risky marketable securities. The line begins with the Risk-Free Rate (with zero risk) and moves upward to the right. As the risk of an investment increases, it is expected that the return on an investment would increase. An investor with a low risk profile would choose an investment at the beginning of the Security Market Line .An investor with a higher risk profile would choose an investment higher along the security market line.[20]

Figure 2.1 The Security Market Line in Capital Asset Pricing Model



The Security Market line graphs the result of the Capital Asset Pricing Model (CAPM) formula. The X-axis represents the risk (beta) and the Y-axis represents the expected returns. The market risk is determined from

[19] http:// www.finance.Asset Pricing and Risk Management_Campbell R. Harvey. Date Accesed 15/14/2010
[20]http:// www.investopedia.com. Date accessed 02/05/2010

the slope of the security Market Line. The Security Market Line is a useful tool in determining whether an asset being considered for a portfolio offers a reasonable expected return for risk. Individual securities are plotted on the SML graph. If the security's risk versus expected return is plotted above the SML, it is undervalued because the investor can expect a greater return for the inhererent risk. A security plotted below the SML is overvalued because the investor would be accepting less return for the amount of risk assumed.[21]

According to Modigliani and Pogue (1974), "CAPM is based on elementary logic and Simple economic principles".[22]
Under CAPM, the relevant risk is the market risk that measures the returns sensitivity of a particular risky security or a portfolio of risky securities to the returns of market portfolio.

The CAPM is based on two fundamentals: a true market portfolio and the market risk. The market risk in its true sense must include every marketable asset such as gold, ornaments, antiques, real estates etc. However, most of the empirical studies use stock indexes as proxy for marketable portfolio. The assumption behind this practice is that every event in the economy, has an impact on the market index performance and consequently, the return on index is a replication of return of true market portfolio

[21] http:// www.wikepedia.org/wikisecurity _market_line. Date accessed 02/05/2010
[22] Modigliani Franco and Pogue, Gerald A (1974). "An introduction to Risk and Return. "Financial Analyst Journal, May- June . p. 73.

(2.1.5) Capital Market Line : (CML) : The Efficient set with a risk less security

James Tobin (1968) extended Markowitz's analysis by allowing the possibility of riskless security to be included in asset-holders portfolio. Once we allow riskless security to be either lent or borrowed by the investor, we obtain a striking result that the efficient set becomes a linear line known as the capital market line (CML)

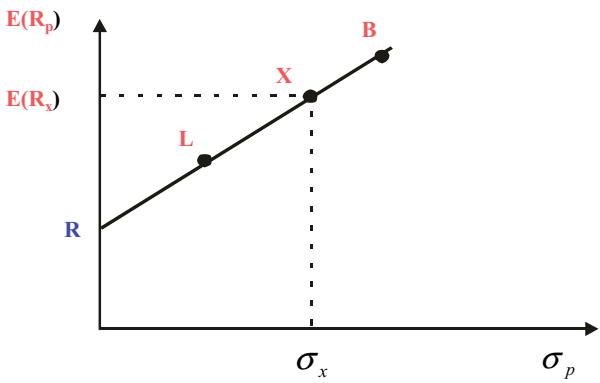
$E(R_p) = wR^+ + (1 - w) E(R_x)$

$E(R_p)$ Expectation of the portfolio

$E(R_x)$ - Expectation of the risky portfolio

R^+ =Riskfree rate,

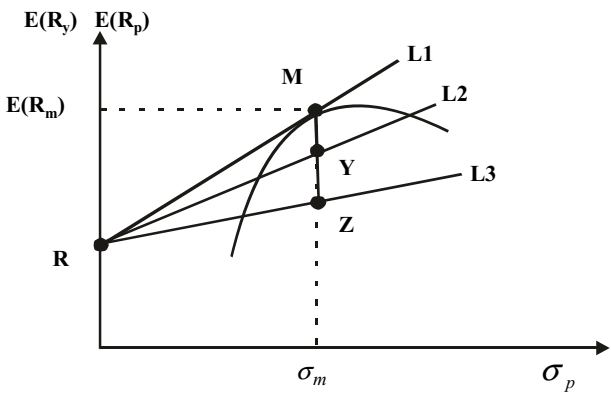
w = Weight in the portfolio



The portfolio opportunity set with a risk-free asset and a risky asset. At point R^+ the entire portfolio is invested in the risk-free security and earns R^+ with zero risk. At point X the entire portfolio is invested in the risky portfolio X, and so has an expected rate of return $E(R_x)$ and a risk of x. At point `L' the investor has some proportion of money in R^+ and some in risky x assets.

The expected return lies between R^+ and $E(R_x)$. At point `B' investor can borrow risk free asset R+ and invest in `X' assets, and hope to earn excess return

The Market Portfolio



The capital market line with N securities

L, L1, L2, L3 are capital market lines. Only L1 is tangential to the portfolio opportunity set at `M'. Portfolio `M' is a unique set on the portfolio effeciency frontier known as the market portfolio, and provides the bench market from which the risk - return trade off can be calculated. The market portfolio is a portfolio made up of all the assets in the economy with weights equal to their market value. The weight of asset (I) in the market portfolio is equal to its market value divided by the total value of all market assets in the economy.

Portfolio `M' is the only portfolio on the efficient frontier and also on the capital market line. This is a well diversified portfolio.

The Market price of Risk

The market portfolio is defined as the portfolio of all risky assets in an economy with weights equal to their relative market value. Once we have calculated the expected return on the market portfolio and the risk -free rate of interest, portfolio then market price of risk is given by the slope of the capital market line

$$\text{market price of risk} = \frac{E(R_m) - R^+}{\sigma m}$$

The relevant equation for portfolio return along the capital market line is :

Expressing the CAPM in Risk-premium Form

E(RP) = Expected Risk premium of the portfolio = E (R_p) - R

Also risk premium on the market portfolio is

$E(RP_m) = E(R_m) - R$

$E(RP_P) = \beta_P \times E(RP_m)$

The above equation tells us that the excess return of a portfolio is equal to the `β' of the portfolio multiplied by the expected risk premium of the market. If the ` β' = 1, then excess return coincides with the market. If `β' < 1 then the portfolio is expected to have a lower expected return than the market.

Typical defensive stocks are companies in relatively stable section of the economy such as food retailers, electricity companies, while aggressive stocks are more volatile than even the market such as property stocks, luxury goods manufacturers, (APM tells us that the required rate of return on a security consists of three components:

1. The price of time as measured by risk-free interest rate - R.
2. The quantity of risk as measured by `β' beta of the security.
3. The unit market price of risk as measured by the slope of the securities market line $[E(R_m) - R]/ \sigma m$

(2.1.6)A Modified Form Of CAPM for developing countries

Greater uncertainty causes investments in emerging markets to tend to be riskier than investments in developed markets. When one is applying the CAPM, this particular risk factor , referred to as " country risk" must somehow be quantified.

The main indicator for what could be considered the " market portfolio " in emerging countries is the Stock Price Index. But this index is rarely a good proxy of the real local business situation?

A Modified Form Of CAPM for developing countries

- In developing countries the great majority of companies are controlled by family groups or a few share holders.
- <u>What Country Risk Really Means ?</u>
- According to CAPM, the only relevant risk is given by beta : a measure of the covariance between the project return and the return of the market portfolio . Hence , a Telephone company , a Restaurant , and a Pin factory will have different (relevant) risk. This does not include Geography.

(2.1.7)Inclusion Of Country Risk in CAPM

- The Kenyan and the Swiss telephone companies are not comparable . It is true that both companies share a common exposure to tariff regulation, costs of supplies , the competition from other fast growing sectors. But investors know that Kenya is riskier . This is why investors demand different return from the same business depending on its location, and is known as country risk.Reputation is the key to assess country risk which is built on country's social and political peace ,stability over

Inclusion Of Country Risk in CAPM

- Institutional consistency and continuity earn a nation trustworthiness.
- <u>How Country Risk is Traditionally Quantified</u>
- Traditionally country risk is quantified as the difference between what is the yield of what is considered a zero risk investment in a country of reference and it's closest equivalent in the country under analysis. The incremental return is known as 'country risk premium'.

Country Risk

- To compute the country risk premium , information is needed about two types of financial instrument :
- 1 A bond of negligible risk such as a U.S Treasury bill.
- 2 A bond from the country under analysis . This bond must be a good proxy for the minimum possible level of risk in the country and have the following attributes : (a) Its maturity , rather duration, must closely match the project's horizon

(b) It must not have any options or special provisions that could affect the value of the bond.

When reference bonds Do Not Exist :Estimating the country risk premium for countries that have no government trading in international financial markets , is to rely on some country risk ranking , published by sources such as The Economist : Suppose country ZUY does not have foreign traded debt and is ranked at level 25. Say countries FRS and TGK do have foreign traded govt. debt

Country Risk

- **And their country risk premiums are known. These two countries are ranked 23 and 29 , respectively.**

Country	Rank	Country Risk Premium (%)
FRS	23	7.40
ZUY	25	Unknown
TGK	29	10.20

- **$R_{country}$ = 7.40 + [(10.20 -7.40)/(29-23)](25-23) =8.33%**
- **ZUY's country risk premium can be computed by interpolation in the aforementioned manner.**

(2.1.8)Critique of the traditional approach to Country Risk

- Country Risk Is Not Totally Systematic and Is Unstable Adding the country risk premium to the risk-free rate , hence to the discount rate , implicitly assumes that the country risk is fully systematic or non-diversifiable. The Public stock returns in developing and developed countries are not highly correlated. To the extent that these returns are truly representative of the local economies , it seems that at least a portion of country risk is diversifiable .

Country Risk diversifiable or not ?

- It is right to add to add the country risk premium to the discount rate only if country risk is systematic.
- Country Risk is not the same for all Projects : The same country risk premium should not apply to every investment in a particular country . Some countries have better reputation in some business sectors than in others . . Hence ,the country premium for more reputable sectors should be lower. This should be the case of investments in

(2.1.9)An Alternative Approach to Country Risk

- Banking sector in Panama..
- Credit Risk is different from Country risk.
- An Alternative Approach to Country Risk
- The main intuition behind this approach is that riskier markets should demand higher market risk premiums. Thus country risk should be taken into account as part of market risk . Therefore, the country risk premium CR should be added to the market risk premium , and not to the risk- free rate

- $E(R_p) = R_F + ß_P [E(R_M) - R_F + CR]$
- CR is computed through the following procedure : A U.S Treasury bond and a bond in local currency with maturities (or durations) comparable to our investment horizon issued by the government of the country under analysis.
- A US corporate bond (in US dollars) with the same credit rating as the bond of emerging country (in local currency) and similar maturity is identified .The difference between this

- $E(R_p) = R_F + ß_P [E(R_M) - R_F + CR]$
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- A US corporate bond (in US dollars) with the same credit rating as the bond of emerging country (in local currency) and similar maturity is identified .The difference between this

- Difference between the emerging market government bond and US treasury is the country risk premium.. This method also assumes that country risk is fully systematic . The effect in this case is to tag each investment with a level of country risk that depends on project's beta. When the project beta is zero there is no country risk. According to this procedure , a low beta firm such as an electrical utility , will have lower country risk than another with higher beta , say a steel mill

- But it is quite likely that electrical utility will suffer from populist government policies and may

have large country risk. There is a variant of this approach (Damodaran 1999). Instead of being added to the market premium , country risk is added to the risk free rate but multiplied bya factor (δ) that can vary as follows between zero and one , depending on how much of the project income come from exports. If export income goes to 100% , country risk is nill.

2.2 Review of Literature For and Against CAPM

Capital Asset Pricing Model has a long history of theoretical and empirical investigation. Several authors have contributed to the development of a model describing the pricing of Capital Assets under conditions of market equilibrium including Eugene Fama, Michael Jensen, John Litner, John Long, Robert Merton, Myron Scholes, William Sharpe, Jack Treynor and Fischer Black among others.

2.2.1Evidence In Favour of CAPM

Black, Jensens and Scholes (1972) [23]tested the CAPM using the equally weighted portfolio of all stocks, traded on the New York Stock Exchange as proxy for the market portfolio. They calculated the relationship between the average monthly returns on the portfolio and the beta of the portfolios between 1926 and 1965. They found a remarkably close relationship between beta and the monthly returns.

Black et al, tested whether the cross section of expected returns is linear in beta they found out that the data is consistent with the predictions of the CAPM. I.e. the relationship between average returns and beta is very close to linear and that portfolios with high betas have high average returns and portfolios with low betas have low average returns.

Blume and Friend (1973)[24], worked on portfolio returns. They found that the estimates of beta for diversified portfolios were more precise than estimates for individual securities. However it was seen that grouping of securities for portfolio formation shrunk the range of betas and reduced statistical power. One way suggested to overcome this problem was to sort the securities on the basis of their betas before forming portfolios. Their tests reported evidences consistent with the mean-variance efficiency of the market portfolio.

[23] Jensen, Michael C, Black Fischer and Scholes, Myron S, The Capital Asset Pricing Model: Some Empirical Test. Michael C, Jesen, STUDIES IN THE THEORY OF CAPITAL MARKETS, Praeger Publisher Inc, 1972. Available at: SSRN: http://ssrn.com/abstract=908569.

[24] Blume, M and Friend, I (1973) . A New look at the Capital Asset Pricing Model, Journal of Finance,28. pp 19.

2.2.2 Evidence against Capital Asset Pricing Model

One of the most important debates in Capital Market today is whether the CAPM is still valid or not. Sharpe (1964) and John Litner (1965) developed the CAPM and showed that the true measure of risk for stock is the beta. Many studies have supported and others have been against the beta.Sharpe and Litner showed that the true measure of risk is the well-known coefficient beta. Investors could choose their stocks in their portfolios according to the value of beta.

Though some criticisms of the CAPM appeared, one of the biggest critics in literature came from French and Fama. In 1992, they stated that previous work from other authors show that average returns on stocks are related to firm characteristics like size, earnings/price, cashflow/price, book-to-market equity, past sales growth, long-term past return, and short-term past return.The book to market equity and size of firm also give additional returns to share holder other than systematic risk. Because these patterns in average returns apparently are not explained by the CAPM, they are called anomalies. Using a large sample of cross-sectional stock data including many small-cap stocks and stocks with large book values, they analysed the accuracy of the CAPM and looked for factors that explain stock prices (besides systematic risk). They found that while CAPM's measure of systematic risk was reliable, firm size and book to market value ratios were also important...[25]Many researchers have documented a significant negative relation between P / B ratios and stock returns. Similarly, the small firms are found to be also earning higher returns. But, Sharpe and CAPM theorists argue (Jonathan 1998) : " May be in

[25] Eugene F. Fama and Kenneth R. French: The Cross-section of Expected Stock Returns. The Journal of Finance.Vol. XL VII, No.2, June 1992

an efficient market , small stocks would do better because they are illiquid , and people demand a premium for illiquidity .That gets to be less compelling if you start thinking about mutual funds that package a bunch of small stocks and therefore make the illiquid liquid As people figured that out , they would put money into those funds, which would drive the prices of small stocks , and there goes the premium..... Since the studies about the size effect were published ,small stocks have not done better than large stocks on average .Since the publicity about the value effect value stocks have not done as well as before around the world "

Arbitrage Pricing Theory (APT): (Ross 1976) assumes that relatively few factors generate correlation , and says that the expected return on a security or an asset ought to be a function of its exposure to those relatively few factors. But according Sharpe (Jonathan 1998) , the APT stops there, and says the expected return you get for factors three could be anything. What that criticism implies is that, even if a particular factor performs badly during bad times, APT does not increase its expected returns for overall period. Sharpe's argument is that the CAPM formulation of the expected return can only perform that function. But the APT theory tries to elaborate the market risk in terms of some macroeconomic factors.

Rolls Critique: The Market Proxy Problem. Roll (1977)[26] argues that the CAPM has never been tested and probably never will be. The problem is that the market portfolio at the heart of the model is theoretically and empirically elusive. It is not clear which assets (for

26(a)Ross, S.A.,1976," Arbitrage Theory of Capital Asset Pricing Capital Asset Pricing," Journal Of Economic Theory 13(3,December) PP.:341-360.

[26](b) Roll, Richard 1997, "A Critique of the Asset Pricing Theory's Test" Part I : On Past and Potential Testability of the Theory", Journal of Financial Economics.4: 2 pp 129.

example, human capital) can legitimately be excluded from the market portfolio, and data availability substantially limits the assets that are included. As a result, tests of the CAPM are found to use proxies for the market portfolio, in effect testing whether the proxies are on the minimum variance frontier. Roll argues that because the test use proxies and not true market portfolio, we learn nothing about the CAPM.

There is another important issue related to the systematic risk emanating from which market risk: the domestic or international , as in the present globalized markets, many of the investors , say in the Indian stock markets, may be foreign investors , for whom the systematic risk may be the US stock market's market or systematic risk.

The important question that is therefore being asked is "Is beta dead"

Sharpe defended his model by saying beta is not dead, and that even the multi-index model realised by Fama and French in 1993, does not eliminate beta. It only adds more variables. Sharpe agrees that CAPM does not reflect the whole reality of the market, but it is important as a guide for investors.

In an interview with Dow Jones Asset Managers (May/June 1998), Sharpe answered at the question by saying "The CAPM is not dead. Anyone who believes markets are so screwy that expected returns are not related to the risk of having a bad time, which is what beta represents, must have a very harsh view of realty".

"Is beta dead"? Is really focused on whether or not individual stocks have higher expected returns if they have higher beta relative to the

market. It would be irresponsible to assume that is not true. That doesn't mean that we can confirm the data. We don't see expected returns, we see realised returns. We don't see ex- ante measures we see realised beta. What makes investment interesting and exciting is that you have lots of noise in the data so it's hard to definitively answer these questions"[27]

2.2.3 Recent Empirical Studies

Several tests have been carried out to ascertain the validity of the CAPM.

Pettengill et al (1995)[28] reinvestigated the relationship between beta and returns conditional on the realised risk premium in different periods, whether it is positive (up) or negative (down). They propose that when the realised risk premium is positive, there should be a positive relationship between the beta and return, and when the premium is negative, the beta and return should be negatively related. Their results document a positive relationship between beta and return in the US market for the period 1926 to 1990. They argue that high beta portfolios receive positive risk premium in up markets and high beta portfolios incur lower returns during down markets.

Cooper (2007)[29] however proved that there is a large bias in that test. He stated that the test statistics that Pettengill et al suggested were almost guaranteed to satisfy the conditions they proposed, whatever

[27] William Sharpe "Revisıtıng Capital Asset Pricing Model" Dow Jones Asset Management, May/ June 1998.

[28] Pettengill, G.Sundaam, S, and Mathur I (19950 The Conditional Relation between Beta and Returns, Journal of Finance and Quantitative Analysis, Volume 30,page 101.

[29] Cooper .Ian. A. On Tests of the Conditional Relationship between Beta and Returns(November 2007). Available at SSRN: http./ssrn.com/abstract=939492

the model that generates expected returns. That even if the CAPM was not true and there was a negative relationship between expected returns and beta, the test would detect statistically significant result in line with their hypothesis.

The reason for the bias is that high beta shares tend to go up when the market goes up, whatever the true asset pricing model. The higher the beta, the stronger the ex-post effect. Thus if they selected periods when ,ex-post, the market has gone up , high beta stocks will have done better in these periods than low beta stocks. The coefficients of the relationship between beta and returns in these periods, is almost guaranteed to be positive, simply because of the definition of beta. This is the main test than Pettingill et al proposed. Cooper however claims that this tell little about the unconditional expected returns on assets, which is what the CAPM explains.

Ali Argun Karacabey(2001)[30], Tested the CAPM applied to Istanbul Stock Exchange (ISE) data over the period 1990-2000. The author run a monthly cross section regression on stocks excess return on a constant and expected beta conditional on the market excess return for the period January 1990 to December 2000. Taking the conditional nature of the relation between beta and return into account, the results of the test showed that there is a conditional relationship between beta and returns. Stock with higher betas has higher returns when the market risk premium is positive and lower returns when the market risk premium is negative. Thus the result of the conditional test support the prediction of CAPM that beta is related to realised returns.

[30] Karacabay, Ali Argun, Beta and Returns: Istanbul Stock Exchange Evidence: Available at SSRN: http://ssrn.com.

They concluded that beta is still living in Istanbul and can be useful for portfolio managers and investors who want to invest in emerging markets.

Grigoris Michailidis et al (2006)[31] carried out a study on testing the CAPM on emerging Greek Securities Market. They used weekly stock returns from 100 companies listed on the Athens Stock Exchange for the period January 1999 to December 2002. Their findings were not supportive of the CAPM's basic statement the higher risk (beta) is associated with higher returns.

Their tests also refuted the CAPM's prediction for the intercept to be equal to zero and the slope equal to the excess returns on the market portfolio. Their test however supported the CAPM's prediction of the expected return-beta relationship of linearity.

Al Refai (2009)[32] carried out an empirical test of the relationship between risk and return in Jordan Capital Markets, the paper examined the relationship between beta and returns on the industrial portfolios of the financial market of Jordan using monthly data for the period of December 1999 to September 2008. The positive risk return relationship was rejected in this emerging market. The test was also conducted on the Pettengill et al model (1995) conditioning on segmenting the up (positive) and down (negative) market risk premium asset significant relationship between beta and returns. The study concluded that during up markets, there was a conclusive statistical evidence for a positive relationship between beta and the

[31] Grigoris Michailidis,Stavros Tsopoglou,Demetrios Papanastasiou, Eleni Mariola. Testing the Capital Asset Pricing Model (CAPM) The Case of the emerging Greek Securities Market, International Research Journal of Finance and Economics, Page 88 Volume 4

[32] Al Refai Hisham, Empirical Test of the Relationship between Risk and Return in the Jordan Capital Market (August 2009), SSRN: http://ssrn.com/abstract=1443367

realised returns for the entire industrial portfolio, and in down markets, the negative relationship was also evident for a number of the industrial portfolios. They concluded that CAPM might not work in this emerging market.

Gürsoy and Rejepova (2007)[33] tested the validity of the CAPM in Turkey by regressing the weekly risk premium against the beta coefficients of 20 portfolios, each including 10 stocks over the period of 1995 -2004. Their test results supported the hypothesis that the beta (systematic risk) is an important factor for determining the returns of a portfolio in Turkey. They stated that estimation of beta, from past prices can be justifiably used by portfolio managers. The test result also made the suggestion that high beta-stocks perform higher in up-market conditions, whereas a low-beta stock is better investment in down-markets.

The CAPM test was also conducted by Uzair and Muhammad (2010)[34] in Pakistan Institutional Framework. They examined the application of the CAPM on the Karachi Stock Exchange (KSE) to form an opinion about the validity and reliability of the model when applied to the institutional framework. They analysed 60 companies selected from KSE-100 index. Covering 6 years (2003-2008). They calculated the beta through variance/covariance approach in order to predict the required return from the underlying security. They used historical returns in calculating the results. The findings suggested that the CAPM gives accurate results for a limited period and for few

[33] Cudi Tuncer Gürsoy and Gulnara Rejepova. "Test of Capital Asset Pricing Model in Turkey. Dogus University Dergisi 8, (1), 2007, pp 42.

[34] Bhatti, Uzair and Hanif,Muhammad, Validity of Capital Asset Pricing Model: Evidence from KSE-Pakistan(January 29,2010). European Journal of Economics, Finance and Administrative Sciences.Available at SSRN:http://ssrn.com/abstract=1544287

companies only. Out of 360 observations, only 28 results supported CAPM, and measured relatively the correct systematic risk of the securities, while 332 were against it, hence the model were rejected in the institutional framework.

Andor et al (1999)[35] tested the CAPM in the Hungarian Capital Markets, based on monthly data of 17 Hungarian companies listed on the Budapest Stock Exchange (BSE). They analysed data collected in the period 31st July 1991 to 1st June 1999.They run a regression and first found the ex-post relationship between the company's beta and their average returns. They concluded that the CAPM acceptably described the Hungarian Capital Market.

Gunnlaugsson(2004)[36], Tested the validity of the CAPM on the Icelandic Stock Market, from January 1999 to May 2004. They indicated that the CAPM worked well in the small Icelandic Stock Market and that the beta coefficients, does explain returns better than on larger foreign stock markets. There was a strong relationship between the beta coefficient and stock returns in the research. Further the stock returns with high betas were higher than one would expect according to the CAPM. They concluded that the CAPM was valid in the Icelandic Stock Market.

Donghui and Xi (2007)[37]Tested the CAPM on the Chinese Stock Market. They tested to see if it holds true in the Shanghai Stock Exchange (SSE). They used weekly stock returns from 100

[35] Gyo Stefan B. Gunnlaugsson: A test of the CAPM on the Icelandic Stock Market. The Business Review, Camdridge Vol.6, No.1 , May 2004

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[37] Xu, Donghui and Yang, Xi, Testing the CAPM Model: A study of the Chinese Stock Market. Handelshogskolan vid Umed Universitel: http://urn.kb.se/resolve urn:nbn:se:umu:diva-1011 (2007)

companies listed on the SSE during 01/01 2000 to 31/12/2005. They tested the CAPM using Black, Jensen and Scholes (1972) (time series test) and Fama and Macbeth (1973) (Cross-Sectional test) methods were used to test the CAPM.

They found that the expected returns and betas are linear related with each other during the entire period 01/01 2000 to 31/12/2005, which implied a strong support of the CAPM hypothesis.

On the other hand,as the CAPM hypothesizes for the intercept to be equal to zero and the slope equal to the average risk premium, the test conducted by Donghui and Xi refuted the above hypothesis and offered evidence against the CAPM. According to the findings of the empirical test, they concluded that the Capital Asset Pricing Model does not give a valid description of the Chinese Stock Market during 01/01/2000 to 31/12/2005.

CHAPTER THREE

3. DATA ANALYSIS

3.1 Introduction to Data Analysis

The data collected for the study are analysed in this chapter. Data analysis involves cleaning and organising the data for analysis, describing the data and testing the hypothesis and the model.

3. 2 Data Presentation and Interpretation

Data are collected from five companies listed on the National Stock Exchange of India. These companies are the State Bank of India, Tata Motors Ltd, HFDC Bank Ltd, Reliance Group of Companies and Infosys Technologies Ltd. Historical data in the form of monthly adjusted closing stock prices for the companies over the period 01/01/2005 to 31/12/2009 are analysed in this chapter. Monthly returns for the market index (S&P CNX Nifty) from the period 01/01/2005 to 31/12/2009 are also collected from the National Stock Exchange India, is used. Treasury bill rates are collected from the Reserve Bank of India in time series from 01/01/2005 to 31/12/2009 to match data from the individual stock of the companies and that of the market index.

3.3. Models: Statistical Techniques

The data would be analysed using simple linear regression to find the relationship between the dependent variables (Returns on Stock and the Risk adjusted Returns) i.e. the Y variables and the Independent Variable the Risk Premium. i.e. the X variable. The Estimation will use the regression line in the form

$R_{it} = R_{ft} + \beta (M_{rt} - R_{ft}) + U_t$ (eqn 3.1)

R_{it} =Required return, $M_{rt} - R_{ft}$= is the market risk premium, that is, the difference between market return and risk free rate. R_{ft} = risk free rate, U_t = error term in regression which follows the usual properties.

Monthly time series data from adjusted closing stock prices of the listed companies are used in estimating the beta or systematic risk of the companies. The beta is the most important component in calculating the required rate of return to the shareholder (from the CAPM). The model is applied in finding the beta for all the five companies listed above. The table below shows the analysis on State Bank of India, similar analysis will be made on all stocks from the 5 companies chosen for the study.

3.4 Analysis of Data of the State Bank of India

From the data below a regression is run to determine the beta of the stock or the systematic risk of the stock. The table below gives the variables needed to run the regression for the estimation of beta or systematic risk of the stock.

Table 3.1 Showing the Returns, Risk Free Rate, Market Return and Risk Premium of State Bank of India stock from the period 01/01/2005 to 31/12/2009

Series	Date	Adj Close	Exp Ret (ER_K)	Risk Free Rate (r_f)	Exp Mkt Ret (M_{rt})	Risk Premium (M_{rt}-Rr_f)
SBIN	01/12/2009	2270.05	0.1876	0.0486	0.4014	0.3529
SBIN	03/11/2009	2235.1	0.2965	0.0706	0.8175	0.747
SBIN	01/10/2009	2181.2	-0.167	0.0703	-0.8786	-0.949
SBIN	01/09/2009	2212	3.2032	0.0874	1.0858	0.9984
SBIN	03/08/2009	1745.95	-0.482	0.0899	0.0664	-0.024
SBIN	01/07/2009	1819	0.4871	0.0915	0.9658	0.8743
SBIN	01/06/2009	1748.05	0.8351	0.0865	-0.4258	-0.512
SBIN	04/05/2009	1634.32	5.3799	0.0742	3.3679	3.2938
SBIN	01/04/2009	1128.42	2.686	0.0699	1.7994	1.7295
SBIN	02/03/2009	922.04	0.3767	0.0445	1.1172	1.0727
SBIN	02/02/2009	893.98	-1.308	0.0448	-0.464	-0.509
SBIN	01/01/2009	1003.32	-1.321	0.0472	-0.3421	-0.389
SBIN	01/12/2008	1127.42	2.2666	0.0728	0.8888	0.816
SBIN	03/11/2008	948.3	-0.312	0.0749	-0.5427	-0.618
SBIN	01/10/2008	973.6	-2.918	0.073	-3.1692	-3.242
SBIN	01/09/2008	1286.48	0.5763	0.0672	-1.2077	-1.275
SBIN	01/08/2008	1227.53	-0.012	0.0675	0.0749	0.0074
SBIN	01/07/2008	1228.8	3.2412	0.0501	0.8684	0.8183
SBIN	02/06/2008	967.48	-2.807	0.0699	-2.044	-2.114
SBIN	02/05/2008	1262.88	-2.125	0.0644	-0.6871	-0.752
SBIN	01/04/2008	1534.66	1.291	0.0737	1.0934	1.0197
SBIN	03/03/2008	1385.59	-2.762	0.07	-1.1234	-1.193
SBIN	01/02/2008	1799.89	-0.422	0.0717	0.201	0.1293
SBIN	01/01/2008	1865.55	-1.015	0.069	-1.9571	-2.026
SBIN	03/12/2007	2037.89	0.3124	0.0725	0.7826	0.7102
SBIN	01/11/2007	1986.19	1.2917	0.0625	-0.2804	-0.343
SBIN	01/10/2007	1793.17	0.7601	0.0652	2.1013	2.0362
SBIN	03/09/2007	1686.36	2.7146	0.0659	1.4983	1.4324
SBIN	01/08/2007	1375.25	-0.206	0.062	-0.1718	-0.234

SBIN	02/07/2007	1399.25	0.7712	0.0636	0.5851	0.5215
SBIN	04/06/2007	1314.76	1.6697	0.0628	0.0629	8E-06
SBIN	03/05/2007	1154.17	2.7416	0.0554	0.6103	0.5548
SBIN	02/04/2007	939.52	1.2967	0.0552	0.8364	0.7812
SBIN	01/03/2007	847.9	-0.546	0.0756	0.2443	0.1687
SBIN	01/02/2007	888.31	-1.037	0.071	-0.9917	-1.063
SBIN	02/01/2007	972.38	-1.013	0.0729	0.3519	0.2789
SBIN	01/12/2006	1062.04	-0.651	0.0606	0.0361	-0.024
SBIN	01/11/2006	1122.96	2.4248	0.0566	0.6743	0.6178
SBIN	03/10/2006	934.19	0.7817	0.0548	0.5207	0.4658
SBIN	01/09/2006	877.06	1.2551	0.0515	0.6134	0.5619
SBIN	01/08/2006	794.01	1.7921	0.0513	1.0335	0.9822
SBIN	03/07/2006	690.84	1.3603	0.0531	0.0575	0.0044
SBIN	01/06/2006	620.5	-1.653	0.0536	-0.2151	-0.269
SBIN	01/05/2006	719.62	-0.419	0.0516	-1.1042	-1.156
SBIN	03/04/2006	745.64	-0.956	0.0516	0.3723	0.3207
SBIN	01/03/2006	810.18	1.2445	0.061	1.2795	1.2185
SBIN	01/02/2006	734.05	-0.12	0.0665	0.2943	0.2278
SBIN	02/01/2006	741.46	-0.288	0.066	0.6961	0.6302
SBIN	01/12/2005	759.69	0.1539	0.0533	0.8339	0.7806
SBIN	01/11/2005	750.07	0.823	0.0519	1.4237	1.3718
SBIN	03/10/2005	701.93	-1.268	0	-1.063	-1.063
SBIN	01/09/2005	784.83	2.1383	0.0479	1.0907	1.0428
SBIN	01/08/2005	666.13	-0.059	0.0451	0.3755	0.3304
SBIN	01/07/2005	669.43	2.0826	0.0447	0.4955	0.4509
SBIN	01/06/2005	570.43	0.4335	0.0437	0.7648	0.7211
SBIN	02/05/2005	550.54	1.7563	0.0438	1.1672	1.1234
SBIN	01/04/2005	480.25	-1.282	0.0436	-0.7849	-0.829
SBIN	01/03/2005	537.69	-1.005	0.0515	-0.3857	-0.437
SBIN	01/02/2005	586.83	1.337	0.0504	0.2662	0.2158
SBIN	03/01/2005	528		0.0514		

Series	Date	Average Adj Closing	Average Exp. Ret (%)	Average Risk Free Rate (%)	Average Exp. Mkt Returns (%)	Average Risk Premium (%)
SBIN	2005-2009	1153.919	40.3	6.0	23.7	17.6

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

In estimating the Beta from the table given above we use the information on State Bank of India from 01/01/2005 to 31/12/2009. The variables in the CAPM stated below are necessary to find the beta of the stock.

The CAPM can be stated as

$R_{it} = R_{ft} + \beta (M_{rt} - R_{ft}) + U_t$

Where R_{it} is is the return on the stock

R_{ft} is the Risk Free Rate of Return

β is the beta of the security

M_{rt} is the market return

$(Mrt - R_{ft})$ is the Equity Risk Premium.

and U_t is the error term

The variables of the above linear equation are explained below.

3.4.1 The Returns on Stock (R_{it})

Monthly adjusted closing price of stocks which was available publicly is used and the returns on the stock prices are calculated by finding the percentage change in adjusted closing price from one month

to the next. The annualised returns are found by multiplying the results by 12. For example the information on State Bank of India shows that from 01/11/2005 to 01/12/2009 the adjusted closing prices were 2270.05 and 2235.1 respectively. The annualised returns is found as

=12* (Pt-Pt-1)/ (Pt-1) (eqn, 3. 2)

=12*(2270.05-2235.1)/2235.1

=0.18764261

This method is used in calculating the Returns for both the stock prices for all five securities and the Market Returns from the S&P CNX Nifty.

3.4.2 The Risk Free Rate of Return (R_{ft})

The Risk Free Rate is obtained in time series data from 01/01/2005 to 31/2/2009. Treasury bill rates from the Reserve Bank of India are used to represent the risk free rate. The monthly-end yields to maturity of SGL Transactions, in Central Government dated securities are used. The data collected are adjusted to correspond to the data of returns on the stock prices and the Nifty. For instance the rate for 01/12/2009 which is 4.8555% is rewritten as 0.04855 to correspond to the stock returns of 0.18764261 and Nifty returns of 0.401414748 for the same day.

3. 4. 3 The Market Returns (M_{rt})

The market proxy is the S&P CNX Nifty which is the leading index for large companies listed on the National Stock Exchange of India. This is used to represent the market data. Time series data from 01/01/2005 to 31/12/2009 are collected and the returns estimated using

simple arithmetic to find the percentage change in price from one period to another.

Table 3.2 showing the market index (S&P CNX Nifty)

SERIES	Date	Adj Close	Exp. Ret.(ER_P)
S&P CNX NIFTY	01/12/2009	5201.05	0.401414748
S&P CNX NIFTY	03/11/2009	5032.7	0.817539317
S&P CNX NIFTY	01/10/2009	4711.7	-0.878647508
S&P CNX NIFTY	01/09/2009	5083.95	1.085819695
S&P CNX NIFTY	03/08/2009	4662.1	0.066386999
S&P CNX NIFTY	01/07/2009	4636.45	0.965766354
S&P CNX NIFTY	01/06/2009	4291.1	-0.425763382
S&P CNX NIFTY	04/05/2009	4448.95	3.367924121
S&P CNX NIFTY	01/04/2009	3473.95	1.799433953
S&P CNX NIFTY	02/03/2009	3020.95	1.117218172
S&P CNX NIFTY	02/02/2009	2763.65	-0.46396271
S&P CNX NIFTY	01/01/2009	2874.8	-0.342057685
S&P CNX NIFTY	01/12/2008	2959.15	0.888751769

S&P CNX NIFTY	03/11/2008	2755.1	-0.54269476
S&P CNX NIFTY	01/10/2008	2885.6	-3.169233908
S&P CNX NIFTY	01/09/2008	3921.2	-1.207706422
S&P CNX NIFTY	01/08/2008	4360	0.074914319
S&P CNX NIFTY	01/07/2008	4332.95	0.868396629
S&P CNX NIFTY	02/06/2008	4040.55	-2.044023737
S&P CNX NIFTY	02/05/2008	4870.1	-0.687121315
S&P CNX NIFTY	01/04/2008	5165.9	1.093420636
S&P CNX NIFTY	03/03/2008	4734.5	-1.123384704
S&P CNX NIFTY	01/02/2008	5223.5	0.200994657
S&P CNX NIFTY	01/01/2008	5137.45	-1.957091193
S&P CNX NIFTY	03/12/2007	6138.6	0.782647174
S&P CNX NIFTY	01/11/2007	5762.75	-0.28044368
S&P CNX NIFTY	01/10/2007	5900.65	2.101347247
S&P CNX NIFTY	03/09/2007	5021.35	1.498252688
S&P CNX NIFTY	01/08/2007	4464	-0.171831701
S&P CNX	02/07/2007	4528.85	0.585091355

NIFTY			
S&P CNX NIFTY	04/06/2007	4318.3	0.062852088
S&P CNX NIFTY	03/05/2007	4295.8	0.610288901
S&P CNX NIFTY	02/04/2007	4087.9	0.836362209
S&P CNX NIFTY	01/03/2007	3821.55	0.244306197
S&P CNX NIFTY	01/02/2007	3745.3	-0.991696671
S&P CNX NIFTY	02/01/2007	4082.7	0.351855587
S&P CNX NIFTY	01/12/2006	3966.4	0.03611076
S&P CNX NIFTY	01/11/2006	3954.5	0.674340963
S&P CNX NIFTY	03/10/2006	3744.1	0.520677739
S&P CNX NIFTY	01/09/2006	3588.4	0.613374733
S&P CNX NIFTY	01/08/2006	3413.9	1.033469076
S&P CNX NIFTY	03/07/2006	3143.2	0.057541078
S&P CNX NIFTY	01/06/2006	3128.2	-0.215113176
S&P CNX NIFTY	01/05/2006	3185.3	-1.104187452
S&P CNX NIFTY	03/04/2006	3508.1	0.372250224
S&P CNX NIFTY	01/03/2006	3402.55	1.279539467

S&P CNX NIFTY	01/02/2006	3074.7	0.294292093
S&P CNX NIFTY	02/01/2006	3001.1	0.696127338
S&P CNX NIFTY	01/12/2005	2836.55	0.833858045
S&P CNX NIFTY	01/11/2005	2652.25	1.423733103
S&P CNX NIFTY	03/10/2005	2370.95	-1.063042977
S&P CNX NIFTY	01/09/2005	2601.4	1.090726102
S&P CNX NIFTY	01/08/2005	2384.65	0.375470311
S&P CNX NIFTY	01/07/2005	2312.3	0.495541745
S&P CNX NIFTY	01/06/2005	2220.6	0.764820004
S&P CNX NIFTY	02/05/2005	2087.55	1.167201051
S&P CNX NIFTY	01/04/2005	1902.5	-0.784908997
S&P CNX NIFTY	01/03/2005	2035.65	-0.385688815
S&P CNX NIFTY	01/02/2005	2103.25	0.266232504
S&P CNX NIFTY	03/01/2005	2057.6	1

For example in Table 3.2 above, for the S& P CNX Nifty, the market price of the Nifty for the period 01/11/2009 and 01/12/2009 is

5032.7 and 5201.05 respectively. The annualised expected returns is estimated by finding

$$= 12*(Pt-Pt-1)/ (Pt-1)$$
$$= 12*(5201.05-5032.7)/5032.7$$
$$= 0.401414748$$

3.4.4 The Risk Premium (Mrt – R_{ft})

This is simply the excess returns the market provides over the risk free rate. That is simply the difference between market returns and the risk free rate. For our example in finding the Risk Premium for 01/12/2009 for State Bank of India, the expected market return is 0.401414748 and the Risk Free Rate is 0.048555, for the same day, the Risk Premium is simply
(0.401414748 minus 0.0485550 giving 0.352859748.

3. 4. 5 The Beta Factor

The beta factor representing the systematic risk of the stock in comparison with the market is estimated from the data by running a regression in excel using the equation $R_{it} = R_{ft} + \beta (M_{rt} – R_{ft}) + U_t$. The simple linear regression model is used, where the dependent variable y is the expected returns on the company's stock in question and the independent variable is the risk premium. The Summary output of the results is found below.

Figure 3:1 Summary results of Regression analysis on State Bank of India Stock to determine the beta factor or systematic Risk.

Regression Statistics	
Multiple R	0.7649
R Square	0.585
Adj R^2	0.5777
Std Error	1.0516
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	88.865	88.865	1.77E-12
Residual	57	63.035	1.1059	
Total	58	151.9		

	Co-eff	*Std Error*	*t Stat*	*Lo. 95%*	*Up 95%*	*Low 95.0%*	*Up 95.0%*
Intercept	0.1977	0.1388	1.4244	-0.08024	0.476	-0.08	0.4757
X Variable 1	1.1692	0.1304	8.9642	0.908036	1.43	0.908	1.4304

3. 5 Interpretation of the Regression Results

From the analysis above, we obtain a beta value of 1.1692, representing the X variable 1. The alpha coefficients 0.1977 represent the intercept. The intercept, provides a simple measure of the performance of the stock during the period 2005 to 2009 when returns are measured against the expected returns from the CAPM. The CAPM suggests the intercept value is not statistically significant from zero. The CAPM also states that the beta of the stock is the measure of its volatility, in terms of

market risk. The beta factor of the market as a whole is 1.0. These two inferences for alpha and beta can be tested with the hypothesis.

3.5.1 Testing the Alpha Value

The significance of alpha is tested in the hypothesis below.

Testing the Hypothesis

$H_{0:}$ = 0. The null hypothesis is that the intercept is equal to zero to or is not statistically significant from zero

H_1: > 0 the alternative hypothesis is that the intercept is greater than zero. This is a single tailed test of the hypothesis

The Test Significance

The null hypothesis of zero significance of the alpha value is rejected if the t-value calculated by the regression is > table value or = table value, otherwise the null hypothesis is accepted.

Results of Hypothesis Test

The regression gave a t-value of 0.902367 for the test of alpha. Then taking 0.05 probability of a deviation greater than t and 59 observations or degrees of freedom, the t table value corresponding to 0.902367 is 1.697. Since the table value is greater than the value from the regression as stated above in the hypothesis test, the null hypothesis of zero significance of alpha is accepted.

Beta would be determined to find out the risk or market sensitivity. The statistical test of zero significance of beta would be determined. The hypothesis formulation would be as follows.

3. 5. 2 Testing the Beta Value

The significance of beta is tested in the hypothesis test below

Testing the Hypothesis

$H_{0:} = \beta = 0$.The null hypothesis is that the market risk or systematic risk (beta) associated with the stock of the SBIN is not statistically significant from zero.

H_1: $\beta > 0$ the alternative hypothesis is that the beta or systematic risk is greater than zero. This is basically a single tailed test of the hypothesis

The Test Significance

The null hypothesis of zero significance of the estimated value of beta is rejected if the t-value calculated by the regression is > table value or = table value, otherwise the null hypothesis is accepted.

The beta-coefficient of the State Bank of India stock is statistically significant from zero at 0.05% level of confidence. The t-value of 8.978022 from the regression corresponding to the t-stat of 1.645 is highly significant. The null hypothesis of zero significance of beta is rejected.

Result of Hypothesis Test

From the regression, the beta value of is 1.1695. Beta indicates the tendency of the stock to respond to swings in the market. A beta of the market portfolio is equal to 1. A security with a beta greater than 1 maybe described as aggressive because it has more risk than the market portfolio. A beta of less than 1 is described as defensive because it has less risk than the market portfolio. The beta of 1.1695 from the regression suggests that the SBIN stock is about 16 percent more volatile than the market.

The interpretation is that when the market returns increases by 1 percent, we expect the returns on the SBIN stock to increase by 1.1695 percent. Similarly, when the market returns decreases by 1 percent, we expect the SBIN returns to fall by 1.1695 percent.

3. 5. 3 The R Squared

The R^2 is also a statistical measure that emerges from the regression. This provides a measure of the goodness of fit for the regression. The economical rational is that it provides an estimate of the proportion of the risk of a firm that can be attributed to the market risk. This is the systematic risk that cannot be diversified away. From the summary of the regression, the R^2 is 0.578503, which is approximately 57%. We can say then that about 57% of the risk factor is systematic and correlated with the return to the market. Thus when the return to the market goes up, systematic risk should also go up and vice versa. The fluctuations in returns brought about by non-market information are called the non-systematic risk, or company's specific risk.

The balance ($1-R^{2)}$ which is about 43% can be attributed to the firm's specific risk. The CAPM only considers the systematic risk in valuation of the stock because it is the risk associated with the movement of the entire market, unlike unsystematic risk which can be diversified away.

3.5.4 Measuring the Performance of the State Bank of India Stock

The CAPM is also used to measure the stock's performance over a period. The performance of the State Bank of India stock from 2005 to 2009 can be measured by comparing the historical risk adjusted returns(that is the returns on the SBIN stock minus the returns on the risk free rate) against those of the appropriate index and in this case the S&P CNX Nifty.

The regression is calculated using returns in excess of the risk free rate for both the stock and the market. In this case, the general equation for this type of regression is

$$(R_{it} - R_{ft}) = \beta (M_{rt} - R_{ft}) + \text{alpha}$$

(eqn 3.3)

Where R_{it} is the stock return rate

R_{ft} is the risk-free rate of return

$(R_{it} - R_f)_{is}$ the risk-adjusted returns

M_{rt} is the return index or market return

$(M_{rt} - R_{ft})$ is the risk premium

B is the beta of the stock

Alpha is the intercept

The table below gives the variables necessary for calculating the risk-adjusted returns to help determine the performance of the stock over the period 2005-2009.

Table 3.3 The table shows the data on the Stock Return (Rit), Risk Free Rate (R_{ft}),

Risk Premium ($M_{rt} – R_{ft}$) and the Risk Adjusted Returns (R_{it} - R_{ft}) on the SBIN stock.

Series	Date	Adj Close	Exp. Ret.(R_{it})	Risk Free Rate (Rr_f)	(Exp. Mkt Ret ER_P)	Risk Premium (R_P-r_f)	Risk-Adj Returns (Rk-rf)
SBIN	01/12/2009	2270.05	0.1876	0.04856	0.4014	0.3529	0.1391
SBIN	03/11/2009	2235.1	0.2965	0.07057	0.8175	0.747	0.226
SBIN	01/10/2009	2181.2	-0.167	0.07028	-0.879	-0.949	-0.237
SBIN	01/09/2009	2212	3.2032	0.08742	1.0858	0.9984	3.1158
SBIN	03/08/2009	1745.95	-0.482	0.08991	0.0664	-0.024	-0.572
SBIN	01/07/2009	1819	0.4871	0.0915	0.9658	0.8743	0.3956
SBIN	01/06/2009	1748.05	0.8351	0.08652	-0.426	-0.512	0.7485
SBIN	04/05/2009	1634.32	5.3799	0.07417	3.3679	3.2938	5.3057
SBIN	01/04/2009	1128.42	2.686	0.06992	1.7994	1.7295	2.616
SBIN	02/03/2009	922.04	0.3767	0.04455	1.1172	1.0727	0.3321
SBIN	02/02/2009	893.98	-1.308	0.04484	-0.464	-0.509	-1.353
SBIN	01/01/2009	1003.32	-1.321	0.04717	-0.342	-0.389	-1.368
SBIN	01/12/2008	1127.42	2.2666	0.07278	0.8888	0.816	2.1938
SBIN	03/11/2008	948.3	-0.312	0.07487	-0.543	-0.618	-0.387
SBIN	01/10/2008	973.6	-2.918	0.07303	-3.169	-3.242	-2.992

SBIN	01/09/2008	1286.48	0.5763	0.06716	-1.208	-1.275	0.5091
SBIN	01/08/2008	1227.53	-0.012	0.06749	0.0749	0.0074	-0.08
SBIN	01/07/2008	1228.8	3.2412	0.05008	0.8684	0.8183	3.1912
SBIN	02/06/2008	967.48	-2.807	0.06988	-2.044	-2.114	-2.877
SBIN	02/05/2008	1262.88	-2.125	0.06441	-0.687	-0.752	-2.19
SBIN	01/04/2008	1534.66	1.291	0.0737	1.0934	1.0197	1.2173
SBIN	03/03/2008	1385.59	-2.762	0.07002	-1.123	-1.193	-2.832
SBIN	01/02/2008	1799.89	-0.422	0.07167	0.201	0.1293	-0.494
SBIN	01/01/2008	1865.55	-1.015	0.06899	-1.957	-2.026	-1.084
SBIN	03/12/2007	2037.89	0.3124	0.0725	0.7826	0.7102	0.2399
SBIN	01/11/2007	1986.19	1.2917	0.06247	-0.28	-0.343	1.2292
SBIN	01/10/2007	1793.17	0.7601	0.0652	2.1013	2.0362	0.6949
SBIN	03/09/2007	1686.36	2.7146	0.0659	1.4983	1.4324	2.6487
SBIN	01/08/2007	1375.25	-0.206	0.06203	-0.172	-0.234	-0.268
SBIN	02/07/2007	1399.25	0.7712	0.06358	0.5851	0.5215	0.7076
SBIN	04/06/2007	1314.76	1.6697	0.06284	0.0629	8E-06	1.6068
SBIN	03/05/2007	1154.17	2.7416	0.05544	0.6103	0.5548	2.6862
SBIN	02/04/2007	939.52	1.2967	0.05518	0.8364	0.7812	1.2415
SBIN	01/03/2007	847.9	-0.546	0.07557	0.2443	0.1687	-0.621
SBIN	01/02/2007	888.31	-1.037	0.07101	-0.992	-1.063	-1.109
SBIN	02/01/2007	972.38	-1.013	0.07294	0.3519	0.2789	-1.086
SBIN	01/12/2006	1062.04	-0.651	0.06055	0.0361	-0.024	-0.712
SBIN	01/11/2006	1122.96	2.4248	0.05658	0.6743	0.6178	2.3682
SBIN	03/10/2006	934.19	0.7817	0.05483	0.5207	0.4658	0.7268
SBIN	01/09/200	877.06	1.2551	0.05148	0.613	0.5619	1.2037

	6				4		
SBIN	01/08/2006	794.01	1.7921	0.05129	1.0335	0.9822	1.7408
SBIN	03/07/2006	690.84	1.3603	0.05312	0.0575	0.0044	1.3072
SBIN	01/06/2006	620.5	-1.653	0.0536	-0.215	-0.269	-1.706
SBIN	01/05/2006	719.62	-0.419	0.05157	-1.104	-1.156	-0.47
SBIN	03/04/2006	745.64	-0.956	0.05155	0.3723	0.3207	-1.007
SBIN	01/03/2006	810.18	1.2445	0.061	1.2795	1.2185	1.1835
SBIN	01/02/2006	734.05	-0.12	0.06653	0.2943	0.2278	-0.186
SBIN	02/01/2006	741.46	-0.288	0.06596	0.6961	0.6302	-0.354
SBIN	01/12/2005	759.69	0.1539	0.0533	0.8339	0.7806	0.1006
SBIN	01/11/2005	750.07	0.823	0.0519	1.4237	1.3718	0.7711
SBIN	03/10/2005	701.93	-1.268	0	-1.063	-1.063	-1.268
SBIN	01/09/2005	784.83	2.1383	0.04789	1.0907	1.0428	2.0904
SBIN	01/08/2005	666.13	-0.059	0.04509	0.3755	0.3304	-0.104
SBIN	01/07/2005	669.43	2.0826	0.04468	0.4955	0.4509	2.038
SBIN	01/06/2005	570.43	0.4335	0.04374	0.7648	0.7211	0.3898
SBIN	02/05/2005	550.54	1.7563	0.04383	1.1672	1.1234	1.7125
SBIN	01/04/2005	480.25	-1.282	0.04361	-0.785	-0.829	-1.326
SBIN	01/03/2005	537.69	-1.005	0.05153	-0.386	-0.437	-1.056
SBIN	01/02/2005	586.83	1.337	0.05045	0.2662	0.2158	1.2866
SBIN	03/01/2005	528		0.05141			-0.051

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

Series	Date	Average Adj. Closing	Average Exp. Ret (%)	Avg Risk Free Rate (%)	Average Market Ret. (%)	Average Risk Premium (%)	Average Risk-Adj Ret.(%0
SBIN	2005 - 2009	1153.91	40.3	6.0	23.7	17.6	33.6

The simple linear regression is run in excel where the risk adjusted returns represent the dependent variable X and the Risk Premium is the independent variable Y. In this case the intercept of the regression should be zero if the actual returns equal the expected returns. If the intercept is greater than zero, then the stock is also receiving returns from non-systematic risk or company specific risk[38]

Testing the Hypothesis

$H_{0:}$ = 0. The null hypothesis: the intercept is equal to zero or is not statistically significant from zero

H_1: > 0 the alternative hypothesis: the intercept is greater than zero.

This is a single-tailed test

The Test Significance

The null hypothesis of zero significance of the alpha value is rejected if the t-value calculated by the regression is > table value or = table value, otherwise the null hypothesis is accepted.

[38] Aswath Damodaran, Valuation Tools and Techniques for determining the value of any asset, John Wiley and Sons Inc 2002

Result of Hypothesis Test

The regression gave a t-value of 0.98735. Then taking 0.05 probability of a deviation greater than t and 59 observations or degrees of freedom, the t table value corresponding to 0.902367 is 1.697. The Summary results of the regression are found below.

Figure 3:2 Summary results of Regression analysis on State Bank of India Stock to determine the alpha coefficient and its significance

Regression Statistics	
Multiple R	0.76507
R Square	0.58533
Adj R^2	0.57806
Std Error	1.05078
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	88.8383	88.8383	1.73E-12
Residual	57	62.9359	1.10414	
Total	58	151.774		

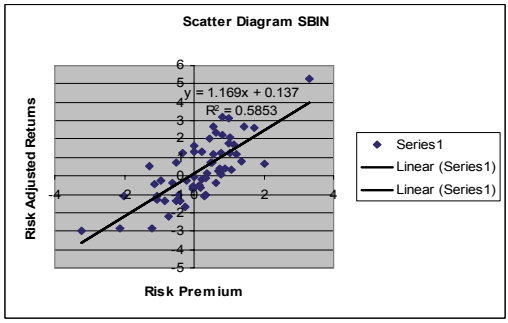
	Co-effi	*Std Error*	*t Stat*	*Low 95%*	*Up95%*	*Low 95.0%*	*Up95.0%*
Intercept	0.13696	0.13871	0.98735	-0.14081	0.4147	-0.14081	0.4147
X Variable 1	1.16905	0.13033	8.96992	0.908066	1.43	0.908066	1.43

Since the table value is greater than the value from the regression as stated above, the null hypothesis of zero significance of alpha is accepted. From the interpretation above the regression's statistical insignificance of the intercept indicates that the returns from the stock is determined by the systematic risk and thus supports the CAPM that there are no returns for non-systematic risks because these non-systematic can easily be diversified away.

3.5.5 Scatter Diagram of State Bank of India Stock

The information can be represented graphically where the least square regression is used to fit a straight line through the data points. This is shown in the scatter diagram for the SBIN stock below.

Fig 3.3: Scatter diagram showing the performance of State Bank of India Stock from
the period 2005 to 2009.



Each point on the graph shows the risk-adjusted returns of the portfolio and that of the index over the period 2005 to 2009. There is a linear relationship between the variable X (risk premium) and Y (risk-adjusted returns). The equation of the line is provided as y=1.169x + 0.137, where

1.169 is the slope representing the beta and 0.137 is the intercept or alpha. The quality of the fit is given by the R^2. Usually an r-squared of 1.0 would mean the model fit the data well with the line going through every data point.

The R^2 measures how well the CAPM predicts the actual performance of the SBIN stock. With the diagram above, for an R^2 of 0.5853, we can conclude that about 58% of the stock's performance is explained by its risk exposure as measured by the beta.

3. 5. 6 The Jensen's Alpha

Another measure of the performance of the stock is to look at the intercept, which provides a simple measure of performance of the stock during the period of regression, when returns are measured against the expected returns from the CAPM.

The evidence of this measure is done by considering the rearrangement of the CAPM

$$R_1 = R_F + \beta (R_m - R_f)$$

(eqn 3.4)

$$= R_f + \beta R_m - \beta R_m$$

$$= R_f (1 - \beta) + \beta R_m$$

When we compare this formulation to that of the returns (R1) of the stock to the return equation in the regression, which is

$$R_1 = \alpha + \beta R_m$$

The intercept α equals RF (1- β) (eqn. 3.5)

A comparison of the intercept α to the $R_F (1- \beta)$ provides a measure of the stock's performance as per the CAPM.

Thus if $\alpha > R_F (1- \beta)$ the stock did better than expected during the regression period

If $\alpha = R_F (1- \beta)$ the stock did as well as expected during the regression period

If $\alpha < R_F (1- \beta)$, the stock did worse than expected during the regression period

The difference between α and $R_F (1- \beta)$ is called the Jensen's alpha[39]. This provides a measure of whether the stock in question earned a higher return than or less than it's required return, given both the market performance and risk.

A simple linear regression is run from the data in table 3.1 to determine the intercept to be used in finding the Jensen's alpha. In this regression, the dependent variable y is the return on the stock and the independent variable is the market return. The Jensen's alpha will be determined to measure whether the stock in question earned a higher return or lesser return than its required return, given both the market performance and risk, and also to find out if the stock earned returns higher than companies of similar beta.

Figure 3:4 Summary results of Regression analysis on State Bank of India Stock to

determine the alpha coefficient and test the Jensen's alpha.

[39] The Jensen's measure is one way to determine if the asset is earning the proper returns for its level of risk. If it is positive, then the asset is earning excess returns. A positive Jensen's alpha means the stock has "beat" the market.

Regression Statistics	
Multiple R	0.7654
R^2	0.5858
Adj R^2	0.5785
Std Error	1.0507
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	88.97875	88.9788	1.7E-12
Residual	57	62.92161	1.10389	
Total	58	151.9004		

	Co-effi	*Std Error*	*t Stat*	*Low95%*	*Up 95%*	*Low95.0%*	*Up95.0%*
Intercept	0.1265	0.140223	0.90237	-0.15426	0.4073	-0.15426	0.40733
X Variable 1	1.1697	0.130279	8.97802	0.90877	1.4305	0.90877	1.43053

From the regression results we find out that the intercept is 0.1265329. This result is compared to the Risk free rate into 1 minus beta of the stock.

The beta of the stock from the initial regression in Figure 3.1 was obtained as 1.16965 and the average of the risk free rate is 0.06082. To calculate the Jensen's alpha we first find R_F (1- β) which equals 0.06082(1-1.6965), the results is -0.197859.

The Jensen's alpha is simply the difference between the intercept α and R_F (1- β),

Which is simply 0.1265329-(-0.197859) giving us 0.324392 returns earned by the firm.

In comparing the results we find out that $\alpha > R_F (1- \beta)$ i.e. 0.1265329 > -0.1978. Therefore, State Bank of India earned more returns than Companies of similar betas.

3.5.7 Analysis of Results of State Bank Of India

The t-value of 8.978022 corresponding to the beta value of 1.16965 is highly significant. The beta shows the tendency of the stock to respond to swings in the market. The beta value of more than 1 indicates that the SBIN stock will perform better in good times when the market excess returns yields very positive results and perform badly in times when the market returns are negative. However during the period of this study, the average returns for SBIN has been very good, with an excess return of about 40%. State Bank of India has been a good investment bet for investors during the sample period of the study.

3.6 Analysis of Data for Tata Motors

The statistical technique used for finding the beta value, the performance of the stock by finding the (alpha value and the Jensen's alpha) and its significance is similar to that of the State Bank of India.
Simple linear regression is used to find the beta of the stock. The estimation from the regression line in Equation 3.1 is used. Beta is determined from the information on the table below

Table 3.4 Returns, Risk Free Rate, Market Returns and Risk Premium of Tata Motors from the period 01/01/2005 to 31/12/2009

Series	Date	Adj Close	Exp. Return (ER_K)	Risk Free Rate(r_f)	Exp. Ret. (ER_P)	Risk Premium (ER_P-r_f)
TATAMOTORS	01/12/2009	782	2.1325	0.0486	0.4014	0.3529
TATAMOTORS	03/11/2009	664	2.0777	0.0706	0.8175	0.747
TATAMOTORS	01/10/2009	566	-0.515	0.0703	-0.879	-0.949
TATAMOTORS	01/09/2009	591.4	2.42	0.0874	1.0858	0.9984
TATAMOTORS	03/08/2009	492.2	2.2	0.0899	0.0664	-0.024
TATAMOTORS	01/07/2009	415.9	5.398	0.0915	0.9658	0.8743
TATAMOTORS	01/06/2009	286.9	-1.529	0.0865	-0.426	-0.512
TATAMOTORS	04/05/2009	328.8	4.4154	0.0742	3.3679	3.2938
TATAMOTORS	01/04/2009	240.3	4.1993	0.0699	1.7994	1.7295
TATAMOTORS	02/03/2009	178	2.429	0.0445	1.1172	1.0727
TATAMOTORS	02/02/2009	148.1	0.1743	0.0448	-0.464	-0.509
TATAMOTORS	01/01/2009	145.9	-0.728	0.0472	-0.342	-0.389
TATAMOTORS	01/12/2008	155.4	1.8601	0.0728	0.8888	0.816
TATAMOTORS	03/11/2008	134.5	-2.368	0.0749	-0.543	-0.618
TATAMOTORS	01/10/2008	167.6	-6.07	0.073	-3.169	-3.242
TATAMOTORS	01/09/2008	339.1	-2.66	0.0672	-1.208	-1.275
TATAMOTORS	01/08/2008	435.7	0.9364	0.0675	0.0749	0.0074
TATAMOTORS	01/07/2008	404.2	-0.424	0.0501	0.8684	0.8183
TATAMOTORS	02/06/2008	419	-2.896	0.0699	-2.044	-2.114
TATAMOTORS	02/05/2008	552.2	-1.493	0.0644	-0.687	-0.752
TATAMOTORS	01/04/2008	630.7	0.7406	0.0737	1.0934	1.0197
TATAMOTORS	03/03/2008	594	-1.356	0.07	-1.123	-1.193
TATAMOTORS	01/02/2008	669.7	0.1176	0.0717	0.201	0.1293
TATAMOTORS	01/01/2008	663.2	-0.762	0.069	-1.957	-2.026
TATAMOTORS	03/12/2007	708.2	0.1644	0.0725	0.7826	0.7102
TATAMOTORS	01/11/2007	698.6	-0.414	0.0625	-0.28	-0.343
TATAMOTORS	01/10/2007	723.6	-0.729	0.0652	2.1013	2.0362
TATAMOTORS	03/09/2007	770.4	1.7606	0.0659	1.4983	1.4324
TATAMOTORS	01/08/2007	671.8	0.0446	0.062	-0.172	-0.234
TATAMOTORS	02/07/2007	669.4	0.5227	0.0636	0.5851	0.5215
TATAMOTORS	04/06/2007	641.4	-1.153	0.0628	0.0629	8E-06
TATAMOTORS	03/05/2007	709.6	0.0631	0.0554	0.6103	0.5548
TATAMOTORS	02/04/2007	705.9	0.3882	0.0552	0.8364	0.7812
TATAMOTORS	01/03/2007	683.8	-0.834	0.0756	0.2443	0.1687
TATAMOTORS	01/02/2007	734.8	-1.308	0.071	-0.992	-1.063
TATAMOTORS	02/01/2007	824.7	-0.297	0.0729	0.3519	0.2789
TATAMOTORS	01/12/2006	845.6	1.3563	0.0606	0.0361	-0.024
TATAMOTORS	01/11/2006	759.8	-0.27	0.0566	0.6743	0.6178
TATAMOTORS	03/10/2006	777.2	-0.473	0.0548	0.5207	0.4658
TATAMOTORS	01/09/2006	809.1	0.225	0.0515	0.6134	0.5619
TATAMOTORS	01/08/2006	794.2	1.6785	0.0513	1.0335	0.9822
TATAMOTORS	03/07/2006	696.8	-0.797	0.0531	0.0575	0.0044
TATAMOTORS	01/06/2006	746.3	0.3001	0.0536	-0.215	-0.269

TATAMOTORS	01/05/2006	728.1	-1.568	0.0516	-1.104	-1.156
TATAMOTORS	03/04/2006	837.6	-0.318	0.0516	0.3723	0.3207
TATAMOTORS	01/03/2006	860.4	1.7003	0.061	1.2795	1.2185
TATAMOTORS	01/02/2006	753.6	1.8251	0.0665	0.2943	0.2278
TATAMOTORS	02/01/2006	654.1	1.011	0.066	0.6961	0.6302
TATAMOTORS	01/12/2005	603.3	2.1073	0.0533	0.8339	0.7806
TATAMOTORS	01/11/2005	513.2	2.1304	0.0519	1.4237	1.3718
TATAMOTORS	03/10/2005	435.8	-1.398	0	-1.063	-1.063
TATAMOTORS	01/09/2005	493.3	1.8929	0.0479	1.0907	1.0428
TATAMOTORS	01/08/2005	426.1	-0.485	0.0451	0.3755	0.3304
TATAMOTORS	01/07/2005	444	1.564	0.0447	0.4955	0.4509
TATAMOTORS	01/06/2005	392.8	-0.21	0.0437	0.7648	0.7211
TATAMOTORS	02/05/2005	399.8	0.5673	0.0438	1.1672	1.1234
TATAMOTORS	01/04/2005	381.8	-0.006	0.0436	-0.785	-0.829
TATAMOTORS	01/03/2005	382	-1.569	0.0515	-0.386	-0.437
TATAMOTORS	01/02/2005	439.5	-0.677	0.0504	0.2662	0.2158
TATAMOTORS	03/01/2005	465.7			1	1

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

Annualised returns on Tata Motors stocks and the returns on the S& P CNX Nifty (market) are calculated using the formula in equation 3.2. Treasury bill rates from the Reserve Bank of India represent the risk free rate. The risk premium is simply the difference between the expected market returns and the risk free rate.

A simple regression is run on the data to determine the beta of the stock.

Fig 3.5 Summary results of Regression analysis on Tata Motors to determine the beta factor or the systematic risk.

Series	Date	Average Adj Closing	Average Exp. Ret (%)	Average Risk Free Rate (%)	Average Exp. Mkt Returns (%)	Average Risk Premium (%)
TATA MOTORS	2005-2009	1153.919	25.5	6.0	24.9	18.9

Regression Statistics	
Multiple R	0.7688
R^2	0.5911
Adjusted R^2	0.5839
Std Error	1.2061
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	119.86	119.86	1.2E-12
Residual	57	82.916	1.4547	
Total	58	202.78		

	Co-effi	*Std Error*	*t Stat*	*Low 95%*	*Up95%*	*Low 95.0%*	*Up95.0%*
Intercept	0.0167	0.1592	0.105	-0.3021	0.3355	-0.3021	0.3355
X Variable 1	1.3579	0.1496	9.0773	1.05836	1.6575	1.05836	1.6575

Analysis of Regression Results

The alpha should not be statistically significant from zero. The beta factor of the market as a whole is 1. A beta greater than 1 suggests the stock is highly volatile as compared to the market and vice versa.

3.6.1 Testing the Alpha Value

The significance of alpha is tested in the hypothesis below.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.

H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.

Result of Test Significance

The t-value for corresponding to the intercept is 0.105001606, taking 0.05 confidence interval and 59 observations, the t-value corresponding to 0.1050016 is 1.697. From the results we can confidently accept the null hypothesis of zero significance of alpha.

3. 6. 2 Testing the Beta Value

The significance of beta is tested in the hypothesis test below

Testing the Hypothesis

$H_{0:} = \beta = 0$. The null hypothesis is that the market risk or systematic risk (beta) associated with the stock of the Tata Motors is not statistically significant from zero.
H_1: $\beta > 0$ the alternative hypothesis is that the beta or systematic risk is greater than zero. This is basically a single tailed test of the hypothesis

The Test Significance

The null hypothesis of zero significance of the estimated value of beta is rejected if the t-value calculated by the regression is > table value or = table value, otherwise the null hypothesis is accepted.

Result of Test Significance

The beta-coefficient of the stock of TataMotors is statistically significant from zero at 0.05% level of confidence. The t-value of 9.07734775 from the regression corresponding to the t-stat of 1.645 is highly significant. The null hypothesis of zero significance of beta is rejected.

From the regression, the beta value is 1.357915. Beta indicates the tendency of the stock to respond to swings in the market. A beta of the market portfolio is equal to 1. A security with a beta greater than 1 maybe described as aggressive because it has more risk than the market portfolio. A beta of less than 1 is described as defensive because it has less risk than the market portfolio. The beta of 1.357915 from the regression suggests that the TataMotors stock is about 35 percent more volatile than the market.

The interpretation is that when the market returns increases by 1 percent, we expect the returns on the TataMotors stock to increase by 1.357915 percent. Similarly, when the market returns decreases by 1 percent, we expect the TataMotors returns to fall by 1.357915 percent.

3.6.3 The R Squared values for Tata Motors

The R Squared that emerges from the regression is 0.59109958 which is approximately 59%. The verification from this results is that about 59% of the risk factor is systematic and about 41 %($1-R^2$) is attributed to the unsystematic risk.

3.6.4 Measuring the Performance of Tata Motors Stock

The performance of Tata Motors over the period 2005 to 2009 will be measured by comparing the Risk-Adjusted returns to the S&P CNX Nifty. The regression is run on the dependent variable y (the risk-adjusted returns) and the independent variable x (the risk-premium).

The general equation for the line is $(R_{it} - R_{ft})$ =Beta $(M_{rt} - R_{ft}) + \alpha$ $(R_{it} - R_{ft}) = \beta (M_{rt} - R_{ft}) + \text{alpha}$ (eqn 3.3)

Where R_{it} is the stock return rate

R_{ft} is the risk-free rate of return

$(R_{it} - R_f)_{is}$ the risk-adjusted returns

M_{rt} is the return index or market return

$(M_{rt} - R_{ft})$ is the risk premium

B is the beta of the stock

Alpha is the intercept

The table for the variables used in calculating the risk-adjusted returns of Tata Motors stock for 2005-2009 is found below.

Table 3.5 Showing the Risk-Adjusted Returns, Market Returns Rate, Returns on Tata Motors stock and the Risk-Free Rate of Return

Series	Date	Adj Close	Exp. Return (ERK)	Risk Free Rate(rf)	Risk-Adjusted Returns	Exp. Ret. (ERP)	Risk Premium (ERP-rf)
TATAMOTORS	1/12/2009	782	2.1325	0.04656	2.08398	0.401415	0.35286
TATAMOTORS	3/11/2009	664	2.0777	0.07057	2.00717	0.817539	0.746967
TATAMOTORS	1/10/2009	566	-0.5154	0.07028	-0.5857	-0.87865	-0.94892
TATAMOTORS	1/9/2009	591.4	2.42	0.08742	2.33258	1.08582	0.998402
TATAMOTORS	3/8/2009	492.15	2.2	0.08991	2.11014	0.066387	-0.02353
TATAMOTORS	1/7/2009	415.9	5.398	0.0915	5.30653	0.965766	0.874264
TATAMOTORS	1/6/2009	286.86	-1.5294	0.08652	-1.6159	-0.42576	-0.51228
TATAMOTORS	4/5/2009	328.76	4.4154	0.07417	4.34126	3.367924	3.293754
TATAMOTORS	1/4/2009	240.33	4.1993	0.06992	4.12937	1.799434	1.729511
TATAMOTORS	2/3/2009	178.03	2.429	0.04455	2.38447	1.117218	1.072669
TATAMOTORS	2/2/2009	148.06	0.1743	0.04484	0.12948	-0.46396	-0.5088
TATAMOTORS	1/1/2009	145.94	-0.7276	0.04717	-0.7748	-0.34206	-0.38922
TATAMOTORS	1/12/2008	155.36	1.8601	0.07278	1.78731	0.888752	0.815976
TATAMOTORS	3/11/2008	134.51	-2.3681	0.07487	-2.4429	-0.54269	-0.61757
TATAMOTORS	1/10/2008	167.58	-6.0699	0.07303	-6.1429	-3.16923	-3.24226
TATAMOTORS	1/9/2008	339.11	-2.6605	0.06716	-2.7276	-1.20771	-1.27487
TATAMOTORS	1/8/2008	435.71	0.9364	0.06749	0.86895	0.074914	0.007429
TATAMOTORS	1/7/2008	404.17	-0.4236	0.05008	-0.4737	0.868997	0.818314
TATAMOTORS	2/6/2008	418.96	-2.8955	0.06988	-2.9655	-2.04402	-2.1139
TATAMOTORS	2/5/2008	552.21	-1.4932	0.06441	-1.5576	-0.68712	-0.75153
TATAMOTORS	1/4/2008	630.69	0.7406	0.0737	0.66687	1.093421	1.01972
TATAMOTORS	3/3/2008	594.03	-1.3564	0.07002	-1.4264	-1.12338	-1.1934
TATAMOTORS	1/2/2008	669.73	0.1176	0.07167	0.04594	0.200995	0.129325
TATAMOTORS	1/1/2008	663.23	-0.7621	0.06899	-0.8311	-1.95709	-2.02608
TATAMOTORS	3/12/2007	708.21	0.1644	0.0725	0.09188	0.782547	0.710151
TATAMOTORS	1/11/2007	698.64	-0.4141	0.06247	-0.4766	-0.28044	-0.34291
TATAMOTORS	1/10/2007	723.61	-0.729	0.0652	-0.7942	2.101347	2.03615
TATAMOTORS	3/9/2007	770.41	1.7606	0.0659	1.6947	1.498253	1.432353
TATAMOTORS	1/8/2007	671.84	0.0446	0.06203	-0.0174	-0.17183	-0.23386
TATAMOTORS	2/7/2007	669.35	0.5227	0.06358	0.45915	0.585091	0.521516
TATAMOTORS	4/6/2007	641.41	-1.1529	0.06284	-1.2157	0.062852	8.09E-06
TATAMOTORS	3/5/2007	709.58	0.0631	0.05544	0.00763	0.610289	0.554847
TATAMOTORS	2/4/2007	705.87	0.3882	0.05518	0.33304	0.836362	0.781186
TATAMOTORS	1/3/2007	683.75	-0.8342	0.07557	-0.9097	0.244306	0.168739
TATAMOTORS	1/2/2007	734.83	-1.3075	0.07101	-1.3786	-0.9917	-1.06271
TATAMOTORS	2/1/2007	824.69	-0.2972	0.07294	-0.3701	0.351856	0.27892
TATAMOTORS	1/12/2006	845.63	1.3563	0.06055	1.29572	0.036111	-0.02444
TATAMOTORS	1/11/2006	759.76	-0.2697	0.05658	-0.3263	0.674341	0.617765
TATAMOTORS	3/10/2006	777.23	-0.4728	0.05483	-0.5276	0.520678	0.465846
TATAMOTORS	1/9/2006	809.11	0.225	0.05148	0.1735	0.613375	0.561895
TATAMOTORS	1/8/2006	794.22	1.6785	0.05129	1.62722	1.033469	0.982179
TATAMOTORS	3/7/2006	696.76	-0.7972	0.05312	-0.8503	0.067541	0.004424
TATAMOTORS	1/6/2006	746.34	0.3001	0.0536	0.24651	-0.21511	-0.26872
TATAMOTORS	1/5/2006	728.13	-1.5682	0.05157	-1.6198	-1.10419	-1.15576
TATAMOTORS	3/4/2006	837.59	-0.3181	0.05155	-0.3697	0.37225	0.320699

TATAMOTORS	1/3/2006	860.4	1.7003	0.061	1.63927	1.279539	1.218539
TATAMOTORS	1/2/2006	753.62	1.8251	0.06653	1.75861	0.294292	0.227759
TATAMOTORS	2/1/2006	654.13	1.011	0.06596	0.94508	0.696127	0.630168
TATAMOTORS	1/12/2005	603.3	2.1073	0.0533	2.05403	0.833858	0.780554
TATAMOTORS	1/11/2005	513.18	2.1304	0.0519	2.07847	1.423733	1.37183
TATAMOTORS	3/10/2005	435.81	-1.3981	0	-1.3981	-1.06304	-1.06304
TATAMOTORS	1/9/2005	493.28	1.8929	0.04789	1.84504	1.090726	1.042833
TATAMOTORS	1/8/2005	426.07	-0.4854	0.04509	-0.5305	0.37547	0.330384
TATAMOTORS	1/7/2005	444.03	1.564	0.04468	1.51936	0.495542	0.450863
TATAMOTORS	1/6/2005	392.83	-0.2104	0.04374	-0.2541	0.76482	0.721082
TATAMOTORS	2/5/2005	399.84	0.5673	0.04383	0.5235	1.167201	1.12337
TATAMOTORS	1/4/2005	381.79	-0.006	0.04361	-0.0496	-0.78491	-0.82852
TATAMOTORS	1/3/2005	381.98	-1.5693	0.05153	-1.6209	-0.38569	-0.43722
TATAMOTORS	1/2/2005	439.45	-0.6769	0.05045	-0.7273	0.266233	0.215785
TATAMOTORS	3/1/2005	465.72				1	1

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

Series	Date	Average Adj. Closing	Average Exp. Ret (%)	Avg Risk Free Rate (%)	Average Market Ret. (%)	Average Risk Premium (%)	Average Risk-Adj Ret.(%0
TATA MOTORS	2005 - 2009	553.119	25.5	6.0	24.9	18.9	19.5

The regression would be run to determine the significance of the intercept. An intercept of zero would indicate actual returns equal expected returns. If the intercept is greater than zero, we can determine if the stock is receiving returns from unsystematic risk as well as systematic risk.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.

H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.

Result of Hypothesis Test

The t-value corresponding to the -0.2773598 at 0.05 level of confidence with 59 degrees of freedom, the t-table value corresponding to -0.2773598 is 1.697

The Summary results of the regression are found below.

Fig: 3.6 Summary results of Regression analysis on Tata Motors to determine the beta factor or the systematic risk.

Regression Statistics	
Multiple R	0.76946
R^2	0.59207
Adj R^2	0.58492
Std Error	1.20352
Obs	59

ANOVA

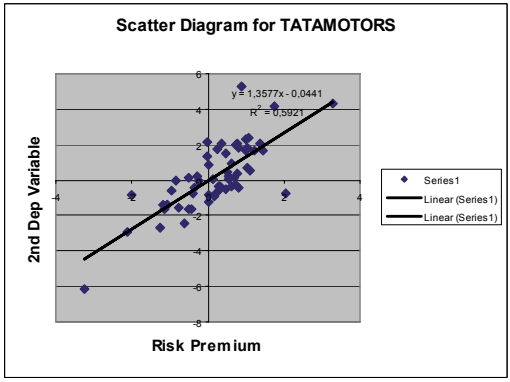
	df	*SS*	*MS*	*Significance F*
Regression	1	119.8311	119.83	1.1E-12
Residual	57	82.5664	1.4484	
Total	58	202.3928		

	Co-efficients	*Std Error*	*t Stat*	*Low95%*	*Up95%*	*Low95.0%*	*Up95.0%*
Intercept	-0.0441	0.158874	-0.2774	-0.36221	0.2741	-0.3622	0.27407
X Variable 1	1.35774	0.149274	9.0956	1.05882	1.6567	1.05882	1.65665

The null hypothesis of zero significance of alpha is accepted, this implies that the returns from the stock is determined by the systematic risk. This supports CAPM that there are no returns for non-systematic risk. Graphically, the Information can be presented in a scatter diagram.

3.6.5 Scatter Diagram for TataMotors Stock

Fig 3.7 Scatter diagram showing the performance of Tata Motors Stock for 2005 to 2009



The points on the graph show the risk-adjusted returns and the index for Tata Motors for the period 2005 to 2009. The equation of the line provided is y = 1.3577x – 0.0441 where 1.3577 is the slope and -0.0441 is the intercept. The R^2 of 0.5921 shows that about 59% of the stocks returns is explained by the exposure to systematic risk.

3.6.6 The Jensen's Alpha

The Jensen's alpha would be used to measure the performance of Tata Motors stock. The measure would be to find out if the stock earned higher returns than other companies having similar betas. A simple linear regression is run to determine the intercept. The dependent variable is the stock returns and the independent variable, the market returns.

Fig. 3.8 Summary results of Regression to determine Jensen's alpha on Tata Motors Stock.

Regression Statistics	
Multiple R	0.77035
R^2	0.59345
Adj R^2	0.58631
Std Error	1.20263
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	120.338	120.34	1E-12
Residual	57	82.4405	1.4463	
Total	58	202.778		

	Co-efficients	*Std Error*	*t Stat*	*Low95%*	*Up95%*	*Low 95.0%*	*Up95.0%*
Intercept	-0.06642	0.16051	-0.4138	-0.388	0.255	-0.388	0.25
X Variable 1	1.36024	0.14912	9.1215	1.062	1.659	1.062	1.66

From the regression results we find out that the intercept is -0.0664159. The beta of the stock from the initial regression in Figure 3.6 is 1.357915. The Jensen's alpha can be found by first finding R_f (1- β) which is 0.060816(1-135715) = -0.021767332. The Jensen's alpha is the result of the intercept α- R_f (1- β) which is -0.0664159-(-0.021767332). That is -0.044648568.. From the analysis we also find out that α < R_f (1- β),i.e -0.0664159 < -0.044648568, which means Tata Motors did not earn returns than companies of similar beta.

3.6.7 Analysis of Results of Tata Motors

The t-stat value of 9.121547043 corresponding to the beta value of 1.36023617 is highly significant. The beta shows the tendency of the stock to respond to swings in the market. The beta value of more than 1 indicates that the TataMotors stock will perform better in good times when the market excess returns yields very positive results and perform badly in times when the market returns are negative. However during the period of this study, the average returns for TataMotors have been about 25.5%.

3.7 Analysis of Data for Reliance Group of Companies

Statistical Technique

The beta value, the stock performance, the Jensen's alpha and its significance of Reliance stock would be found in this analysis.

Simple linear regression is used to find the beta of the stock. The estimation from the regression line is Equation 1.1 is used. Beta is determined from the information in the table below.

Table 3.6 Showing the Returns, Risk Free Rate, Market Returns and Risk Premium of Reliance Group of Companies from the period 01/01/2005 to 31/12/2009

Series	Date	Adj Close	Exp. Return (ERK)	Risk Free Rate(rf)	Exp. Ret. (ERP)	Risk Premium (ERP-rf)
RELIANCE	1/12/2009	1093.35	0.4009	0.04856	0.40141	0.35286
RELIANCE	3/11/2009	1058	-5.412	0.07057	0.81754	0.746967
RELIANCE	1/10/2009	1927	-1.421	0.07028	-0.8786	-0.94892
RELIANCE	1/9/2009	2185.83	1.2026	0.08742	1.08582	0.998402
RELIANCE	3/8/2009	1986.73	0.1501	0.08991	0.06639	-0.02353
RELIANCE	1/7/2009	1962.18	-0.325	0.0915	0.96577	0.874264
RELIANCE	1/6/2009	2016.85	-1.217	0.08652	-0.4258	-0.51228
RELIANCE	4/5/2009	2244.48	2.9685	0.07417	3.36792	3.293754
RELIANCE	1/4/2009	1799.36	2.2714	0.06992	1.79943	1.729511
RELIANCE	2/3/2009	1512.98	2.5481	0.04455	1.11722	1.072669
RELIANCE	2/2/2009	1247.98	-0.671	0.04484	-0.464	-0.5088
RELIANCE	1/1/2009	1321.84	0.9468	0.04717	-0.3421	-0.38922
RELIANCE	1/12/2008	1225.17	1.0314	0.07278	0.88875	0.815976
RELIANCE	3/11/2008	1128.2	-2.022	0.07487	-0.5427	-0.61757
RELIANCE	1/10/2008	1356.82	-3.579	0.07303	-3.1692	-3.24226
RELIANCE	1/9/2008	1933.45	-1.017	0.06716	-1.2077	-1.27487
RELIANCE	1/8/2008	2112.57	-0.481	0.06749	0.07491	0.007429
RELIANCE	1/7/2008	2200.74	0.7547	0.05008	0.8684	0.818314
RELIANCE	2/6/2008	2070.52	-1.59	0.06988	-2.044	-2.1139
RELIANCE	2/5/2008	2386.72	-0.898	0.06441	-0.6871	-0.75153
RELIANCE	1/4/2008	2579.85	1.8927	0.0737	1.09342	1.01972
RELIANCE	3/3/2008	2228.38	-0.893	0.07002	-1.1234	-1.1934
RELIANCE	1/2/2008	2407.53	-0.294	0.07167	0.20099	0.129325
RELIANCE	1/1/2008	2468.07	-1.631	0.06899	-1.9571	-2.02608
RELIANCE	3/12/2007	2856.33	0.175	0.0725	0.78265	0.710151
RELIANCE	1/11/2007	2815.28	0.2628	0.06247	-0.2804	-0.34291
RELIANCE	1/10/2007	2754.94	2.5495	0.0652	2.10135	2.03615
RELIANCE	3/9/2007	2272.2	2.0776	0.0659	1.49825	1.432353
RELIANCE	1/8/2007	1936.86	0.4087	0.06203	-0.1718	-0.23386
RELIANCE	2/7/2007	1873.06	1.3616	0.06358	0.58509	0.521516
RELIANCE	4/6/2007	1682.19	-0.397	0.06284	0.06285	8.09E-06
RELIANCE	3/5/2007	1739.81	1.5201	0.05544	0.61029	0.554847
RELIANCE	2/4/2007	1544.2	1.6704	0.05518	0.83636	0.781186
RELIANCE	1/3/2007	1355.51	0.2134	0.07557	0.24431	0.168739
RELIANCE	1/2/2007	1331.83	-0.123	0.07101	-0.9917	-1.06271
RELIANCE	2/1/2007	1345.57	0.9098	0.07294	0.35186	0.27892
RELIANCE	1/12/2006	1250.74	0.2478	0.06055	0.03611	-0.02444
RELIANCE	1/11/2006	1225.43	0.1805	0.05658	0.67434	0.617765
RELIANCE	3/10/2006	1207.27	0.5557	0.05483	0.52068	0.465846
RELIANCE	1/9/2006	1153.84	0.5841	0.05148	0.61337	0.561895

RELIANCE	1/8/2006	1100.28	1.6987	0.05129	1.03347	0.982179
RELIANCE	3/7/2006	963.84	-0.918	0.05312	0.05754	0.004424
RELIANCE	1/6/2006	1043.65	1.4591	0.0536	-0.2151	-0.26872
RELIANCE	1/5/2006	930.51	-0.517	0.05157	-1.1042	-1.15576
RELIANCE	3/4/2006	972.41	3.0569	0.05155	0.37225	0.320699
RELIANCE	1/3/2006	774.99	1.4642	0.061	1.27954	1.218539
RELIANCE	1/2/2006	690.71	-0.085	0.06653	0.29429	0.227759
RELIANCE	2/1/2006	695.63	-2.367	0.06596	0.69613	0.630168
RELIANCE	1/12/2005	866.54	0.8156	0.0533	0.83386	0.780554
RELIANCE	1/11/2005	811.39	1.1047	0.0519	1.42373	1.37183
RELIANCE	3/10/2005	742.99	-0.469	0	-1.063	-1.06304
RELIANCE	1/9/2005	773.24	1.2368	0.04789	1.09073	1.042833
RELIANCE	1/8/2005	700.99	0.2738	0.04509	0.37547	0.330384
RELIANCE	1/7/2005	685.35	1.1354	0.04468	0.49554	0.450863
RELIANCE	1/6/2005	626.11	2.4124	0.04374	0.76482	0.721082
RELIANCE	2/5/2005	521.31	0.3285	0.04383	1.1672	1.12337
RELIANCE	1/4/2005	507.42	-0.396	0.04361	-0.7849	-0.82852
RELIANCE	1/3/2005	524.72	-0.22	0.05153	-0.3857	-0.43722
RELIANCE	1/2/2005	534.52	0.5398	0.05045	0.26623	0.215785
RELIANCE	3/1/2005	511.51			1	

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free

Rate in Percentages

Series	Date	Average Adj Closing	Average Exp. Ret (%)	Average Risk Free Rate (%)	Average Exp. Mkt Returns (%)	Average Risk Premium (%)
RELIANCE	2005-2009	1462.963	26.2	6.0	24.9	18.9

Annualised returns on Reliance stocks and the returns on the S& P CNX Nifty (market index) are calculated using the formula in equation 3.2. Treasury bill rates from the Reserve Bank of India represent the risk free rate. The risk premium is simply the difference between the expected market returns and the risk free rate.

A simple regression is run on the data to determine the beta of the stock.

Fig 3.9 Summary results of Regression analysis on Reliance stock to determine the beta factor or the systematic risk.

Regression Statistics	
Multiple R	0.64604
R^2	0.41737
Adj R^2	0.40715
Std Error	1.18339
Obs	59

ANOVA

	df	SS	MS	F	Significance
Regression	1	57.1824	57.182	3.3E-08	
Residual	57	79.8238	1.4004		
Total	58	137.006			

	Co-effi	Std Error	t Stat	Low 95%	Up 95%	Low 95.0%	Up 95.0%
Intercept	0.09701	0.15622	0.621	-0.21581	0.4098	-0.216	0.41
X Variable 1	0.93791	0.14678	6.39	0.644	1.2318	0.644	1.232

3.7.1 Analysis of Regression Results of Reliance

The alpha should not be statistically significant from zero. The beta factor of the market as a whole is 1. A beta greater than 1 suggests the stock is highly volatile compared to the market and vice versa.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.

H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.

Results of Hypothesis Test

The t-value corresponding to the intercept is 0.62099294, taking 0.05 confidence interval and 59 observations, the t-value corresponding to 0.62099294 is 1.697. From the results we can accept the null hypothesis of zero significance of alpha.

3. 7. 2 Testing the Beta Value

The significance of beta is tested in the hypothesis test below

Testing the Hypothesis

$H_{0:} = \beta = 0$. The null hypothesis is that the market risk or systematic risk (beta) associated with the stock of the Reliance Group of Companies stock is not statistically significant from zero.
H_1: $\beta > 0$ the alternative hypothesis is that the beta or systematic risk is greater than zero. This is basically a single tailed test of the hypothesis

The Test Significance

The null hypothesis of zero significance of the estimated value of beta is rejected if the t-value calculated by the regression is > table value or = table value, otherwise the null hypothesis is accepted.
Results of Hypothesis Test

The beta-coefficient of the stock of Reliance Group of Companies is statistically significant from zero at 0.05% level of confidence. The t-value of 6.3900243 from the regression corresponding to the t-stat of

1.645 is highly significant. The null hypothesis of zero significance of beta is rejected.

From the regression, the beta value of is 0.9379132. Beta indicates the tendency of the stock to respond to swings in the market. A beta of the market portfolio is equal to 1. A security with a beta greater than 1 maybe described as aggressive because it has more risk than the market portfolio. A beta of less than 1 is described as defensive because it has less risk than the market portfolio. The beta of 0.9379132 from the regression suggests that the Reliance stock is the same as 1 and thus equal to the market portfolio.

The interpretation is that when the market returns increases by 1 percent, we expect the returns on the Reliance stock to increase 1 by percent. Similarly, when the market returns decreases by 1 percent, we expect the Reliance returns to fall by 1 percent.

3.7.3 The R Square values

The R Squared that emerges from the regression is 0.41737099, which is approximately 41%. From this result it can be verified that about 41% of the risk factor is systematic and about 59 %($1-R^2$) is attributed to the unsystematic risk.

3.7.4 Measuring the Performance of Reliance Group of Companies Stock

The performance of Reliance group of companies over the period 2005 to 2009 will be measured by comparing the risk-adjusted returns to the S&P CNX Nifty. The regression is run on the dependent variable y

(the risk-adjusted returns) and the independent variable x (the risk-premium).

The general equation for the line is $R_{it} - R_{ft}$=Beta $(M_{rt} - R_{ft}) + \alpha$

Where R_{it} is the stock return rate

R_{ft} is the risk-free rate of return

$(R_{it} - R_f)$ is the risk-adjusted returns

M_{rt} is the return index or market return

$(M_{rt} – R_{ft})$ is the risk premium

B is the beta of the stock

Alpha is the intercept

The table for the variables used in calculating the risk-adjusted returns of Reliance stock for 2005-2009 is found below.

Table 3.7 Showing the Risk-Adjusted Returns, Market Returns Rate, Returns on Reliance stock and the Risk-Free Rate of Return

Series	Date	Adj Close	Exp. Return (Rit)	Risk Free Rate (Rrf)	Exp. Ret. (Mrt)	Risk Premium (Mrt -Rrf)	Risk-Adjusted Returns (Rit - Rrf)
RELIANCE	1/12/2009	1093.35	0.400945	0.048555	0.401415	0.35286	0.35239
RELIANCE	3/11/2009	1058	-5.41152	0.070572	0.817539	0.746967	-5.48209
RELIANCE	1/10/2009	1927	-1.42095	0.070275	-0.87865	-0.94892	-1.49123
RELIANCE	1/9/2009	2185.83	1.202579	0.087418	1.08582	0.998402	1.115161
RELIANCE	3/8/2009	1986.73	0.150139	0.089913	0.066387	-0.02353	0.060226
RELIANCE	1/7/2009	1962.18	-0.32528	0.091502	0.965766	0.874264	-0.41678
RELIANCE	1/6/2009	2016.85	-1.21701	0.086518	-0.42576	-0.51228	-1.30353
RELIANCE	4/5/2009	2244.48	2.968522	0.07417	3.367924	3.293754	2.894352
RELIANCE	1/4/2009	1799.36	2.271385	0.069923	1.799434	1.729511	2.201462
RELIANCE	2/3/2009	1512.98	2.548118	0.044549	1.117218	1.072669	2.503569
RELIANCE	2/2/2009	1247.98	-0.67052	0.044835	-0.46396	-0.5088	-0.71535
RELIANCE	1/1/2009	1321.84	0.94684	0.047166	-0.34206	-0.38922	0.899674
RELIANCE	1/12/2008	1225.17	1.031413	0.072776	0.888752	0.815976	0.958637
RELIANCE	3/11/2008	1128.2	-2.02196	0.074871	-0.54269	-0.61757	-2.09683
RELIANCE	1/10/2008	1356.82	-3.57887	0.073027	-3.16923	-3.24226	-3.65189
RELIANCE	1/9/2008	1933.45	-1.01745	0.067164	-1.20771	-1.27487	-1.08462
RELIANCE	1/8/2008	2112.57	-0.48077	0.067485	0.074914	0.007429	-0.54825
RELIANCE	1/7/2008	2200.74	0.754709	0.050083	0.868397	0.818314	0.704626
RELIANCE	2/6/2008	2070.52	-1.5898	0.069877	-2.04402	-2.1139	-1.65967
RELIANCE	2/5/2008	2386.72	-0.89833	0.064405	-0.68712	-0.75153	-0.96274
RELIANCE	1/4/2008	2579.85	1.892693	0.073701	1.093421	1.01972	1.818992
RELIANCE	3/3/2008	2228.38	-0.89295	0.070015	-1.12338	-1.1934	-0.96296
RELIANCE	1/2/2008	2407.53	-0.29435	0.07167	0.200995	0.129325	-0.36602
RELIANCE	1/1/2008	2468.07	-1.63116	0.068991	-1.95709	-2.02608	-1.70015
RELIANCE	3/12/2007	2856.33	0.174974	0.072496	0.782647	0.710151	0.102478
RELIANCE	1/11/2007	2815.28	0.26283	0.062467	-0.28044	-0.34291	0.200363
RELIANCE	1/10/2007	2754.94	2.549459	0.065197	2.101347	2.03615	2.484262
RELIANCE	3/9/2007	2272.2	2.077631	0.0659	1.498253	1.432353	2.011731
RELIANCE	1/8/2007	1936.86	0.408743	0.062027	-0.17183	-0.23386	0.346716
RELIANCE	2/7/2007	1873.06	1.361582	0.063575	0.585091	0.521516	1.298007
RELIANCE	4/6/2007	1682.19	-0.39742	0.062844	0.062852	8.09E-06	-0.46027
RELIANCE	3/5/2007	1739.81	1.520088	0.055442	0.610289	0.554847	1.464646
RELIANCE	2/4/2007	1544.2	1.670427	0.055176	0.836362	0.781186	1.615251
RELIANCE	1/3/2007	1355.51	0.213361	0.075567	0.244306	0.168739	0.137794
RELIANCE	1/2/2007	1331.83	-0.12254	0.07101	-0.9917	-1.06271	-0.19355
RELIANCE	2/1/2007	1345.57	0.909829	0.072936	0.351856	0.27892	0.836893
RELIANCE	1/12/2006	1250.74	0.247848	0.06055	0.036111	-0.02444	0.187298
RELIANCE	1/11/2006	1225.43	0.180506	0.056576	0.674341	0.617765	0.12393
RELIANCE	3/10/2006	1207.27	0.555675	0.054832	0.520678	0.465846	0.500843
RELIANCE	1/9/2006	1153.84	0.584142	0.05148	0.613375	0.561895	0.532662
RELIANCE	1/8/2006	1100.28	1.698705	0.05129	1.033469	0.982179	1.647415
RELIANCE	3/7/2006	963.84	-0.91766	0.053117	0.057541	0.004424	-0.97078
RELIANCE	1/6/2006	1043.65	1.459071	0.053604	-0.21511	-0.26872	1.405467
RELIANCE	1/5/2006	930.51	-0.51707	0.051573	-1.10419	-1.15576	-0.56864
RELIANCE	3/4/2006	972.41	3.056865	0.051551	0.37225	0.320699	3.005314
RELIANCE	1/3/2006	774.99	1.464232	0.061	1.279539	1.21854	1.403232
RELIANCE	1/2/2006	690.71	-0.08487	0.066533	0.294292	0.227759	-0.15141

RELIANCE	2/1/2006	695.63	-2.36679	0.065959	0.696127	0.630168	-2.43275
RELIANCE	1/12/2005	866.54	0.815637	0.053304	0.833858	0.780554	0.762333
RELIANCE	1/11/2005	811.39	1.104726	0.051903	1.423733	1.37183	1.052823
RELIANCE	3/10/2005	742.99	-0.46945	0	-1.06304	-1.06304	-0.46945
RELIANCE	1/9/2005	773.24	1.236822	0.047893	1.090726	1.042833	1.188929
RELIANCE	1/8/2005	700.99	0.273845	0.045086	0.37547	0.330384	0.228759
RELIANCE	1/7/2005	685.35	1.135392	0.044579	0.495542	0.450863	1.090713
RELIANCE	1/6/2005	626.11	2.412384	0.043738	0.76482	0.721082	2.368646
RELIANCE	2/5/2005	521.31	0.328485	0.043831	1.167201	1.12337	0.284654
RELIANCE	1/4/2005	507.42	-0.39564	0.043609	-0.78491	-0.82852	-0.43925
RELIANCE	1/3/2005	524.72	-0.22001	0.051531	-0.38569	-0.43722	-0.27154
RELIANCE	1/2/2005	534.52	0.539813	0.050448	0.266233	0.215785	0.489365
RELIANCE	3/1/2005	511.51			1	1	0

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

Series	Date	Average Adj. Closing	Average Exp. Ret (%)	Avg Risk Free Rate (%)	Average Market Ret. (%)	Average Risk Premium (%)	Average Risk-Adj Ret.(%)
RELIANCE	2005 - 2009	1462.96	26.2	6.0	24.9	18.9	19.7

The regression would be run to determine the significance of the intercept. An intercept of zero would indicate actual returns equal expected returns. If the intercept is greater than zero, we can determine if the stock is receiving returns from unsystematic risk as well as systematic risk.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.

H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.

The Summary results of the regression are found below.

Fig 3.10 Summary results of Regression Analysis on Reliance Stock to determine the alpha coefficient and its significance

Regression Statistics	
Multiple R	0.9999
R^2	0.9999
$AdjR^2$	0.9999
Std Error	0.0145
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	136.9942	136.9942	2E-117
Residual	57	0.011991	0.00021	
Total	58	137.0062		

	Co-effi	*Std Error*	*t Stat*	*Low95%*	*Up95%*	*Low95.0%*	*Up 95.0%*
Intercept	0.0612	0.00190	32.1453	0.05741	0.0650	0.05741	0.0650
X Variable 1	0.9979	0.00123	806.964	0.99549	1.0004	0.99549	1.0004

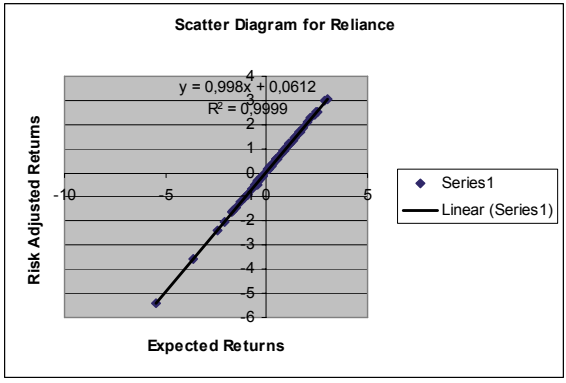
The t-value corresponding to the 0.231064 at 0.05 level of confidence with 59 degrees of freedom, the t-table value corresponding to 0.231064 is 1.697

The null hypothesis of zero significance of alpha is accepted, this implies that the returns from the stock is determined by the systematic risk. This supports CAPM that there are no returns for non-systematic risk.

Graphically, the Information can be presented in a scatter diagram.

3.7.5 Scatter Diagram for Reliance Stock

Fig 3.11 Scatter diagram showing the performance of Reliance stock for 2005 to 2009



The points on the graph show the risk-adjusted returns and the index for Reliance for the period 2005 to 2009. The equation of the line provided is y = 0.998 x +0.0612 where 0.998 is the slope and 0.0612 is the intercept. The R^2 of 0.999 shows that about 99% of the stocks returns is explained by the exposure to systematic risk. The high R squared also indicates the stock's performance has been in line with the index.

3.7.6 The Jensen's Alpha

The Jensen's alpha is also a measure of the performance of Reliance stock. The measure would be to find out if the stock earned higher returns than other companies having similar betas. The table 3.6 below gives the variables needed for calculating the Jensen's alpha.

Fig. 3.12 Summary results of Regression to determine Jensen's alpha on Reliance Stock.

Regression Statistics	
Multiple R	0.64304
R^2	0.41350
Adj R^2	0.40321
Std Error	1.18731
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	56.652	56.652	4E-08
Residual	57	80.354	1.4097	
Total	58	137.01		

	Co-effi	*Std Error*	*t Stat*	*Low 95%*	*Up95%*	*Low 95.0%*	*Up 95.0%*
Intercept	0.04106	0.1585	0.2591	-0.2763	0.3584	-0.276	0.3584
X Variable 1	0.9333	0.1472	6.3393	0.63849	1.2281	0.6385	1.2281

From the regression results we find out that the intercept is 0.04106187. The beta of the stock from the initial regression in Figure 3.9 is 0.93791316. The Jensen's alpha can be found by first finding R_f (1- β) which is 0.060816(1-0.93791316) = 0.003776. The Jensen's alpha is the

result of the intercept α- R_f (1- β) which is 0.04106187-0.003776 That is 0.03728587.

From the analysis we also find out that $\alpha > R_f$ (1- β),i.e 0.04106187 < 0.03728587, which means Reliance earned returns than companies of similar beta.

3.7.7 Analysis of Results

The t-stat value of 6.339323 corresponding to the beta value of 0.933301052 is highly significant. The beta shows the tendency of the stock to respond to swings in the market. The beta value of 1 indicates that the Reliance stock will perform the same as the market. When the market swings up Reliance stock will also swing up and vice versa. During the study period Reliance made an average excess return of 26.2%

3.8 Analysis of Data for HDFC Bank Ltd

Statistical Technique

The beta value, the performance, the Jensen's alpha and its significance of HDFC Bank would be the basis for this analysis.

Simple linear regression is used to find the beta of the stock. The estimation from the regression line in Equation 3.1 is used. Beta is determined from the information on the table below.

Table 3.8 Returns, Risk Free Rate, Market Returns and Risk Premium of HDFC Bank from the period 01/01/2005 to 31/12/2009

SERIES	Date	Adj Close	Exp. Ret. (ER_K)	Risk Free Rate(r_f)	Exp. Ret .(ERp)	Risk Premium (ER_P-r_f)
HFDC	01/12/2009	130.08	-0.3987	0.0486	0.4014	0.3529
HFDC	02/11/2009	134.55	2.59723	0.0706	0.8175	0.747
HFDC	01/10/2009	110.61	-0.7867	0.0703	-0.8786	-0.9489
HFDC	01/09/2009	118.37	2.41925	0.0874	1.0858	0.9984
HFDC	03/08/2009	98.51	0.09083	0.0899	0.0664	-0.0235
HFDC	01/07/2009	97.77	-0.6237	0.0915	0.9658	0.8743
HFDC	01/06/2009	103.13	0.50945	0.0865	-0.4258	-0.5123
HFDC	01/05/2009	98.93	4.12989	0.0742	3.3679	3.2938
HFDC	01/04/2009	73.6	2.57907	0.0699	1.7994	1.7295
HFDC	02/03/2009	60.58	2.33563	0.0445	1.1172	1.0727
HFDC	02/02/2009	50.71	-1.3857	0.0448	-0.464	-0.5088
HFDC	02/01/2009	57.33	-2.3063	0.0472	-0.3421	-0.3892
HFDC	01/12/2008	70.97	2.97521	0.0728	0.8888	0.816
HFDC	03/11/2008	56.87	-1.5363	0.0749	-0.5427	-0.6176
HFDC	01/10/2008	65.22	-2.7336	0.073	-3.1692	-3.2423
HFDC	02/09/2008	84.46	-0.7349	0.0672	-1.2077	-1.2749
HFDC	01/08/2008	89.97	1.88962	0.0675	0.0749	0.0074
HFDC	01/07/2008	77.73	1.09137	0.0501	0.8684	0.8183
HFDC	02/06/2008	71.25	-3.3793	0.0699	-2.044	-2.1139
HFDC	01/05/2008	99.18	-1.3878	0.0644	-0.6871	-0.7515
HFDC	01/04/2008	112.15	1.85851	0.0737	1.0934	1.0197
HFDC	03/03/2008	97.11	-1.196	0.07	-1.1234	-1.1934
HFDC	01/02/2008	107.86	-1.0256	0.0717	0.201	0.1293
HFDC	02/01/2008	117.94	-1.0246	0.069	-1.9571	-2.0261
HFDC	03/12/2007	128.95	-0.361	0.0725	0.7826	0.7102
HFDC	01/11/2007	132.95	-0.3886	0.0625	-0.2804	-0.3429

HFDC	01/10/2007	137.4	3.56941	0.0652	2.1013	2.0362
HFDC	04/09/2007	105.9	2.50188	0.0659	1.4983	1.4324
HFDC	01/08/2007	87.63	0.28171	0.062	-0.1718	-0.2339
HFDC	02/07/2007	85.62	0.33569	0.0636	0.5851	0.5215
HFDC	01/06/2007	83.29	-0.0972	0.0628	0.0629	8E-06
HFDC	01/05/2007	83.97	2.13438	0.0554	0.6103	0.5548
HFDC	02/04/2007	71.29	1.52324	0.0552	0.8364	0.7812
HFDC	01/03/2007	63.26	-0.3463	0.0756	0.2443	0.1687
HFDC	01/02/2007	65.14	-1.5665	0.071	-0.9917	-1.0627
HFDC	03/01/2007	74.92	0.13443	0.0729	0.3519	0.2789
HFDC	01/12/2006	74.09	-0.0836	0.0606	0.0361	-0.0244
HFDC	01/11/2006	74.61	1.16841	0.0566	0.6743	0.6178
HFDC	02/10/2006	67.99	1.61388	0.0548	0.5207	0.4658
HFDC	01/09/2006	59.93	0.88125	0.0515	0.6134	0.5619
HFDC	01/08/2006	55.83	0.60508	0.0513	1.0335	0.9822
HFDC	03/07/2006	53.15	-0.0896	0.0531	0.0575	0.0044
HFDC	01/06/2006	53.55	0.36483	0.0536	-0.2151	-0.2687
HFDC	01/05/2006	51.97	-1.1352	0.0516	-1.1042	-1.1558
HFDC	03/04/2006	57.4	0.9498	0.0516	0.3723	0.3207
HFDC	01/03/2006	53.19	0.2959	0.061	1.2795	1.2185
HFDC	01/02/2006	51.91	-1.2619	0.0665	0.2943	0.2278
HFDC	03/01/2006	58.01	2.0149	0.066	0.6961	0.6302
HFDC	01/12/2005	49.67	0.31742	0.0533	0.8339	0.7806
HFDC	01/11/2005	48.39	1.4666	0.0519	1.4237	1.3718
HFDC	03/10/2005	43.12	-1.645	0	-1.063	-1.063
HFDC	01/09/2005	49.97	0.82927	0.0479	1.0907	1.0428
HFDC	01/08/2005	46.74	-0.6874	0.0451	0.3755	0.3304
HFDC	01/07/2005	49.58	1.10773	0.0447	0.4955	0.4509
HFDC	01/06/2005	45.39	1.32387	0.0437	0.7648	0.7211
HFDC	02/05/2005	40.88	-0.345	0.0438	1.1672	1.1234
HFDC	01/04/2005	42.09	0.3946	0.0436	-0.7849	-0.8285
HFDC	01/03/2005	40.75	-1.281	0.0515	-0.3857	-0.4372
HFDC	01/02/2005	45.62	0.68691	0.0504	0.2662	0.2158
HFDC	03/01/2005	43.15		0.0514		-0.0514

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

Series	Date	Average Adj Closing	Average Exp. Ret (%)	Average Risk Free Rate (%)	Average Exp. Mkt Returns (%)	Average Risk Premium (%)
HDFC	2005-2009	76.0	32.5	6.0	23.7	17.2

Annualised returns on HDFC stocks and the returns on the S& P CNX Nifty (market) are calculated using the formula in equation 3.2. Treasury bill rates form the Reserve Bank of India represents the risk free rate. The risk premium is simply the difference between the expected market returns and the risk free rate.

A simple regression is run on the data to determine the beta of the stock.

Fig 3.13 Summary results of Regression analysis on HFDC stock to determine the beta factor or the systematic risk.

Regression Statistics	
Multiple R	0.799569
R^2	0.639311
Adj R^2	0.632983
Std Error	0.94843
Obs	59

ANOVA

	df	SS	MS	Significance F
Regression	1	90.8791	90.879	3.1E-14
Residual	57	51.27257	0.8995	
Total	58	142.1517		

	Co-effi	Std Error	t Stat	Low95%	Up95%	Low95.0%	Up95.0%
Intercept	0.116699	0.125201	0.9321	-0.134	0.36741	-0.134	0.3674
X Variable 1	1.182397	0.117635	10.051	0.94684	1.41796	0.94684	1.418

3.8.1 Testing the Alpha Value

The alpha should not be statistically significant from zero. The beta factor of the market as a whole is 1.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.

H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.

Results of Hypothesis Test

The t-value for corresponding to the intercept is 0.93209696, taking 0.05 confidence interval and 59 observations, the t-value corresponding to 0.93209696 is 1.697. From the results we can confidently accept the null hypothesis of zero significance of alpha.

3. 8. 2 Testing the Beta Value

The significance of beta is tested in the hypothesis test below

Testing the Hypothesis

$H_{0:} = \beta = 0$.The null hypothesis is that the market risk or systematic risk (beta) associated with the stock of the HDFC Bank is not statistically significant from zero.
H_1: $\beta > 0$ the alternative hypothesis is that the beta or systematic risk is greater than zero. This is basically a single tailed test of the hypothesis

The Test Significance

The null hypothesis of zero significance of the estimated value of beta is rejected if the t-value calculated by the regression is > table value or = table value, otherwise the null hypothesis is accepted.

The beta-coefficient of the HDFC Bank is stock is statistically significant from zero at 0.05% level of confidence. The t-value of 10.0514079 from the regression corresponding to the t-stat of 1.645 is highly significant. The null hypothesis of zero significance of beta is rejected.

From the regression, the beta value of is 1.18239744. Beta indicates the tendency of the stock to respond to swings in the market. A beta of the market portfolio is equal to 1. A security with a beta greater than 1 maybe described as aggressive because it has more risk than the market portfolio. A beta of less than 1 is described as defensive because it has less risk than the market portfolio. The beta of 1.18239744 from the regression suggests that the HDFC Bank stock is about 18 percent more volatile than the market.

The interpretation is that when the market returns increases by 1 percent, we expect the returns on the HDFC Bank stock to increase by 1.18239744 percent. Similarly, when the market returns decreases by 1 percent, we expect the HDFC returns to fall by 1.18239744 percent.

3.8.3 The R Squared

The R Squared that emerges from the regression is 0.63931082, which is approximately 63%. From this result it can be verified that about 63% of the risk factor is systematic and about 36 %($1-R^2$) is attributed to the unsystematic risk.

3.8.4 Measuring the Performance of HDFC Bank Stock

The performance of HDFC over the period 2005 to 2009 will be measured by comparing the risk-adjusted returns to the S&P CNX Nifty. The regression is run on the dependent variable y (the risk-adjusted returns) and the independent variable x (the risk-premium).

The general equation for the line is $(R_{it} - R_{ft}) = \text{Beta}\ (M_{rt} - R_{ft}) + \alpha$

Where R_{it} is the stock return rate

R_{ft} is the risk-free rate of return

$(R_{it} - R_f)_{is}$ the risk-adjusted returns

M_{rt} is the return index or market return

$(M_{rt} - R_{ft})$ is the risk premium

B is the beta of the stock

Alpha is the intercept

The table for the variables used in calculating the risk-adjusted returns of HDFC stock for 2005-2009 is found below.

Table 3.9 Showing the Risk-Adjusted Returns, Market Returns, Returns on HDFC stock and the Risk-Free Rate of Return

Series	Date	Adj Close	Exp .Ret .(ER_K)	Risk Free Rate (r_f)	Exp. Ret. (ERp)	Risk Premium (ER_P-r_f)	Rısk-Adjusted Returns
HFDC	01/12/2009	130.08	-0.3987	0.0486	0.4014	0.353	-0.447
HFDC	02/11/2009	134.55	2.59723	0.0706	0.8175	0.747	2.5267
HFDC	01/10/2009	110.61	-0.7867	0.0703	-0.879	-0.949	-0.857
HFDC	01/09/2009	118.37	2.41925	0.0874	1.0858	0.998	2.3318
HFDC	03/08/2009	98.51	0.09083	0.0899	0.0664	-0.024	0.0009
HFDC	01/07/2009	97.77	-0.6237	0.0915	0.9658	0.874	-0.715
HFDC	01/06/2009	103.13	0.50945	0.0865	-0.426	-0.512	0.4229
HFDC	01/05/2009	98.93	4.12989	0.0742	3.3679	3.294	4.0557
HFDC	01/04/2009	73.6	2.57907	0.0699	1.7994	1.73	2.5091

HFDC	02/03/2009	60.58	2.33563	0.0445	1.1172	1.073	2.2911
HFDC	02/02/2009	50.71	-1.3857	0.0448	-0.464	-0.509	-1.43
HFDC	02/01/2009	57.33	-2.3063	0.0472	-0.342	-0.389	-2.353
HFDC	01/12/2008	70.97	2.97521	0.0728	0.8888	0.816	2.9024
HFDC	03/11/2008	56.87	-1.5363	0.0749	-0.543	-0.618	-1.611
HFDC	01/10/2008	65.22	-2.7336	0.073	-3.169	-3.242	-2.807
HFDC	02/09/2008	84.46	-0.7349	0.0672	-1.208	-1.275	-0.802
HFDC	01/08/2008	89.97	1.88962	0.0675	0.0749	0.007	1.8221
HFDC	01/07/2008	77.73	1.09137	0.0501	0.8684	0.818	1.0413
HFDC	02/06/2008	71.25	-3.3793	0.0699	-2.044	-2.114	-3.449
HFDC	01/05/2008	99.18	-1.3878	0.0644	-0.687	-0.752	-1.452
HFDC	01/04/2008	112.15	1.85851	0.0737	1.0934	1.02	1.7848
HFDC	03/03/2008	97.11	-1.196	0.07	-1.123	-1.193	-1.266
HFDC	01/02/2008	107.86	-1.0256	0.0717	0.201	0.129	-1.097
HFDC	02/01/2008	117.94	-1.0246	0.069	-1.957	-2.026	-1.094
HFDC	03/12/2007	128.95	-0.361	0.0725	0.7826	0.71	-0.434
HFDC	01/11/2007	132.95	-0.3886	0.0625	-0.28	-0.343	-0.451
HFDC	01/10/2007	137.4	3.56941	0.0652	2.1013	2.036	3.5042
HFDC	04/09/2007	105.9	2.50188	0.0659	1.4983	1.432	2.436
HFDC	01/08/2007	87.63	0.28171	0.062	-0.172	-0.234	0.2197
HFDC	02/07/2007	85.62	0.33569	0.0636	0.5851	0.522	0.2721
HFDC	01/06/2007	83.29	-0.0972	0.0628	0.0629	8E-06	-0.16
HFDC	01/05/2007	83.97	2.13438	0.0554	0.6103	0.555	2.0789
HFDC	02/04/2007	71.29	1.52324	0.0552	0.8364	0.781	1.4681
HFDC	01/03/2007	63.26	-0.3463	0.0756	0.2443	0.169	-0.422
HFDC	01/02/2007	65.14	-1.5665	0.071	-0.992	-1.063	-1.637

HFDC	03/01/2007	74.92	0.13443	0.0729	0.3519	0.279	0.0615
HFDC	01/12/2006	74.09	-0.0836	0.0606	0.0361	-0.024	-0.144
HFDC	01/11/2006	74.61	1.16841	0.0566	0.6743	0.618	1.1118
HFDC	02/10/2006	67.99	1.61388	0.0548	0.5207	0.466	1.5591
HFDC	01/09/2006	59.93	0.88125	0.0515	0.6134	0.562	0.8298
HFDC	01/08/2006	55.83	0.60508	0.0513	1.0335	0.982	0.5538
HFDC	03/07/2006	53.15	-0.0896	0.0531	0.0575	0.004	-0.143
HFDC	01/06/2006	53.55	0.36483	0.0536	-0.215	-0.269	0.3112
HFDC	01/05/2006	51.97	-1.1352	0.0516	-1.104	-1.156	-1.187
HFDC	03/04/2006	57.4	0.9498	0.0516	0.3723	0.321	0.8983
HFDC	01/03/2006	53.19	0.2959	0.061	1.2795	1.219	0.2349
HFDC	01/02/2006	51.91	-1.2619	0.0665	0.2943	0.228	-1.328
HFDC	03/01/2006	58.01	2.0149	0.066	0.6961	0.63	1.9489
HFDC	01/12/2005	49.67	0.31742	0.0533	0.8339	0.781	0.2641
HFDC	01/11/2005	48.39	1.4666	0.0519	1.4237	1.372	1.4147
HFDC	03/10/2005	43.12	-1.645	0	-1.063	-1.063	-1.645
HFDC	01/09/2005	49.97	0.82927	0.0479	1.0907	1.043	0.7814
HFDC	01/08/2005	46.74	-0.6874	0.0451	0.3755	0.33	-0.732
HFDC	01/07/2005	49.58	1.10773	0.0447	0.4955	0.451	1.0631
HFDC	01/06/2005	45.39	1.32387	0.0437	0.7648	0.721	1.2801
HFDC	02/05/2005	40.88	-0.345	0.0438	1.1672	1.123	-0.389
HFDC	01/04/2005	42.09	0.3946	0.0436	-0.785	-0.829	0.351
HFDC	01/03/2005	40.75	-1.281	0.0515	-0.386	-0.437	-1.333
HFDC	01/02/2005	45.62	0.68691	0.0504	0.2662	0.216	0.6365
HFDC	03/01/2005	43.15		0.0514		-0.051	

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

Series	Date	Average Adj. Closing	Average Exp. Ret (%)	Avg Risk Free Rate (%)	Average Market Ret. (%)	Average Risk Premium (%)	Average Risk-Adj Ret .(%)
HDFC	2005-2009	76.0	32.5	6.0	23.7	17.2	33.6

The regression would be run to determine the significance of the intercept. An intercept of zero would indicate actual returns equal expected returns. If the intercept is greater than zero, we can determine if the stock is receiving returns from unsystematic risk as well as systematic risk.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.

H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.

The t-value corresponding to the 0.447467 at 0.05 level of confidence with 59 degrees of freedom, the t-table value corresponding to 0.447467 is 1.697

The Summary results of the regression are found below.

Fig. 3.1.3 Showing Result of Regression run to determine the performance of HDFC over the period 2005 to 2009

Regression Statistics	
Multiple R	0.800091
R^2	0.640146
Adj R^2	0.633832
Std Error	0.946572
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	90.852	90.852	3E-14
Residual	57	51.072	0.896	
Total	58	141.924		

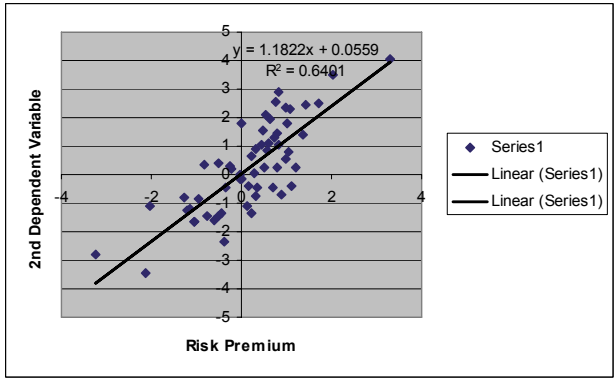
	Co-effi	Std Error	t Stat	Low 95%	Up 95%	Low95.0 %	Up 95.0%
Intercept	0.055913	0.12496	0.4475	-0.1943	0.3061	-0.19431	0.30613
X Variable 1	1.182221	0.1174	10.07	0.9471	1.4173	0.94712	1.41732

The t-stat is not significantly different from zero.The null hypothesis of zero significance of alpha is accepted, this implies that the returns from the stock is determined by the systematic risk. This supports CAPM that there are no returns for non-systematic risk.

Graphically, the Information can be presented in a scatter diagram.

3.8.5 Scatter Diagram for HDFC Stock

Fig 3.14 Scatter diagram showing the performance of Reliance stock for 2005 to 2009



The points on the graph show the risk-adjusted returns and the index for HDFC for the period 2005 to 2009. The equation of the line provided is y = 1.1822 x +0.0559 where 1.1822 is the slope and 0.0559 is the intercept. The R^2 of 0.6491 shows that about 64% of the stocks returns is explained by the exposure to systematic risk.

3.8.6 The Jensen's Alpha

The Jensen's alpha would be used to measure the performance of HDFC stock. The measure would be to find out if the stock earned higher returns than other companies having similar betas. The table below gives the variables needed for calculating the Jensen's alpha.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.
H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.
The t-value from the regression is 0.352403063, with 59 degrees of freedom and 0.05 confidence interval, the t-table value is 1.648. The null hypothesis of zero significance of alpha is accepted.

Fig. 3.15 Summary results of Regression to determine Jensen's alpha on HDFC Stock.

Regression Statistics	
Multiple R	0.8006
R^2	0.641
Adj R^2	0.6347
Std Error	0.9463
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	91.114	91.114	3E-14
Residual	57	51.038	0.8954	
Total	58	142.15		

	Co-effi	*Std Error*	*t Stat*	*Low 95%*	*Up 95%*	*Low 95.0%*	*Up 95.0%*
Intercept	0.0445	0.1263	0.3524	-0.208	0.297	-0.208	0.297
X Variable 1	1.1836	0.1173	10.087	0.9486	1.419	0.949	1.419

A simple linear regression is run to determine the intercept. The dependent variable is the stock returns and the independent variable, the market returns. The intercept from the regression is 0.04450479. The beta of the stock from the initial regression in Figure 3.12 is 1.18239744. The Jensen's alpha can be found by first finding R_f (1- β) which is 0.060816(1-1.18239744) = -0.01109. The Jensen's alpha is the result of the intercept α- R_f (1- β) which is 0.04450479 – (-0.01109) That is 0.055595.

This shows that HDFC did not earn returns than companies of similar beta. However from the analysis we also find that $\alpha > R_f (1- \beta)$, i.e. 0.04450479 > -0.01109 which means that HDFC Bank earned returns than companies of similar beta

3.8.7 Analysis of Results of HDFC Bank

The t-stat value of 10.0874747 corresponding to the beta value of 1.18359944 is highly significant. The beta shows the tendency of the stock to respond to swings in the market. The beta value of more than 1 indicates that the HDFC Bank stock will perform better in good times when the market excess returns yields very positive results and perform badly in times when the market returns are negative. However during the period of this study, the average returns for HDFC Bank Stock have been about 32.5%.

3.9 Analysis of Data Infosystch Ltd

Statistical Technique

The beta value, the performance of the stock and the Jensen's alpha and its significance of Infosystch Ltd would be found in this analysis.

Simple linear regression is used to find the beta of the stock. The estimation from the regression line in Equation 3.1 is used. Beta is determined from the information on the table below.

Table 3.10 Returns, Risk Free Rate, Market Returns and Risk Premium of Infosystch Ltd from the period 01/01/2005 to 31/12/2009

Series	Date	Adj Close	Exp. Return (R_{it})	Risk Free Rate (Rr_f)	Exp. Ret. (M_{it})	Risk Premium (M_{kt}-Rft)
INFOSYSTCH	01/12/2009	2385	0.0038	0.0486	0.4014	0.3529
INFOSYSTCH	03/11/2009	2384.3	0.9187	0.0706	0.8175	0.747
INFOSYSTCH	01/10/2009	2214.7	-0.413	0.0703	-0.879	-0.9489
INFOSYSTCH	01/09/2009	2293.7	0.9797	0.0874	1.0858	0.9984
INFOSYSTCH	03/08/2009	2120.6	0.3985	0.0899	0.0664	-0.0235
INFOSYSTCH	01/07/2009	2052.4	1.9165	0.0915	0.9658	0.8743
INFOSYSTCH	01/06/2009	1769.8	1.3803	0.0865	-0.426	-0.5123
INFOSYSTCH	04/05/2009	1587.2	0.8596	0.0742	3.3679	3.2938
INFOSYSTCH	01/04/2009	1481.1	1.5113	0.0699	1.7994	1.7295
INFOSYSTCH	02/03/2009	1315.4	0.9682	0.0445	1.1172	1.0727
INFOSYSTCH	02/02/2009	1217.2	-0.729	0.0448	-0.464	-0.5088
INFOSYSTCH	01/01/2009	1296	2.0461	0.0472	-0.342	-0.3892
INFOSYSTCH	01/12/2008	1107.2	-1.242	0.0728	0.8888	0.816
INFOSYSTCH	03/11/2008	1235.1	-1.215	0.0749	-0.543	-0.6176
INFOSYSTCH	01/10/2008	1374.2	-0.072	0.073	-3.169	-3.2423
INFOSYSTCH	01/09/2008	1382.5	-2.373	0.0672	-1.208	-1.2749
INFOSYSTCH	01/08/2008	1723.2	1.2912	0.0675	0.0749	0.0074
INFOSYSTCH	01/07/2008	1555.8	-1.015	0.0501	0.8684	0.8183
INFOSYSTCH	02/06/2008	1699.6	-1.513	0.0699	-2.044	-2.1139
INFOSYSTCH	02/05/2008	1944.8	1.7078	0.0644	-0.687	-0.7515
INFOSYSTCH	01/04/2008	1702.5	2.6829	0.0737	1.0934	1.0197
INFOSYSTCH	03/03/2008	1391.4	-0.756	0.07	-1.123	-1.1934
INFOSYSTCH	01/02/2008	1484.9	0.0778	0.0717	0.201	0.1293
INFOSYSTCH	01/01/2008	1475.3	-1.666	0.069	-1.957	-2.0261
INFOSYSTCH	03/12/2007	1713.2	1.1963	0.0725	0.7826	0.7102
INFOSYSTCH	01/11/2007	1557.9	-1.533	0.0625	-0.28	-0.3429
INFOSYSTCH	01/10/2007	1785.9	-0.262	0.0652	2.1013	2.0362
INFOSYSTCH	03/09/2007	1825.8	0.2076	0.0659	1.4983	1.4324
INFOSYSTCH	01/08/2007	1794.7	-0.734	0.062	-0.172	-0.2339
INFOSYSTCH	02/07/2007	1911.6	0.2908	0.0636	0.5851	0.5215
INFOSYSTCH	04/06/2007	1866.4	0.075	0.0628	0.0629	8E-06
INFOSYSTCH	03/05/2007	1854.8	-0.745	0.0554	0.6103	0.5548
INFOSYSTCH	02/04/2007	1977.6	0.1914	0.0552	0.8364	0.7812
INFOSYSTCH	01/03/2007	1946.5	-0.34	0.0756	0.2443	0.1687
INFOSYSTCH	01/02/2007	2003.3	-0.906	0.071	-0.992	-1.0627
INFOSYSTCH	02/01/2007	2167	0.0295	0.0729	0.3519	0.2789
INFOSYSTCH	01/12/2006	2161.7	0.3419	0.0606	0.0361	-0.0244
INFOSYSTCH	01/11/2006	2101.8	0.4822	0.0566	0.6743	0.6178
INFOSYSTCH	03/10/2006	2020.6	1.6279	0.0548	0.5207	0.4658
INFOSYSTCH	01/09/2006	1779.3	0.2873	0.0515	0.6134	0.5619
INFOSYSTCH	01/08/2006	1737.7	1.0934	0.0513	1.0335	0.9822

INFOSYSTCH	03/07/2006	1592.6	-5.548	0.0531	0.0575	0.0044
INFOSYSTCH	01/06/2006	2961.8	0.2079	0.0536	-0.215	-0.2687
INFOSYSTCH	01/05/2006	2911.3	-0.249	0.0516	-1.104	-1.1558
INFOSYSTCH	03/04/2006	2972.9	0.609	0.0516	0.3723	0.3207
INFOSYSTCH	01/03/2006	2829.4	0.6467	0.061	1.2795	1.2185
INFOSYSTCH	01/02/2006	2684.7	-0.214	0.0665	0.2943	0.2278
INFOSYSTCH	02/01/2006	2733.4	-0.467	0.066	0.6961	0.6302
INFOSYSTCH	01/12/2005	2844	1.3965	0.0533	0.8339	0.7806
INFOSYSTCH	01/11/2005	2547.5	0.7732	0.0519	1.4237	1.3718
INFOSYSTCH	03/10/2005	2393.3	0.0618	0	-1.063	-1.063
INFOSYSTCH	01/09/2005	2381.1	0.703	0.0479	1.0907	1.0428
INFOSYSTCH	01/08/2005	2249.3	0.5695	0.0451	0.3755	0.3304
INFOSYSTCH	01/07/2005	2147.4	-0.457	0.0447	0.4955	0.4509
INFOSYSTCH	01/06/2005	2232.4	0.6112	0.0437	0.7648	0.7211
INFOSYSTCH	02/05/2005	2124.2	2.3128	0.0438	1.1672	1.1234
INFOSYSTCH	01/04/2005	1780.9	-1.969	0.0436	-0.785	-0.8285
INFOSYSTCH	01/03/2005	2130.6	0.0916	0.0515	-0.386	-0.4372
INFOSYSTCH	01/02/2005	2114.4	0.9946	0.0504	0.2662	0.2158
INFOSYSTCH	03/01/2005	1952.6		0.0514	1	0.9486

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

SERIES	Date	Average Adj Closing	Average Exp. Ret (%)	Average Risk Free Rate (%)	Average Exp. Mkt Returns (%)	Average Risk Premium (%)
SBIN	2005-2009	1966.389	12.07	6.0	24.9	18.8

Annualised returns on Infosystch Technologies stocks and the returns on the S& P CNX Nifty (market returns) are calculated using the formula in equation 3.2. Treasury bill rates form the Reserve Bank of India represents the risk free rate. The risk premium is simply the difference between the expected market returns and the risk free rate.

A simple regression is run on the data to determine the beta of the stock.

Fig 3.16 Summary results of Regression analysis on Infosystch stock to determine the beta factor or the systematic risk.

Regression Statistics	
Multiple R	0.3965
R^2	0.1572
Adj R^2	0.1424
Std Error	1.2103
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	15.576	15.576	0.0019
Residual	57	83.4991	1.4649	
Total	58	99.0751		

	Co-effi	Std Error	t Stat	Low95%	Up95%	Low95.0%	Up95.0%
Intercept	0.0346	0.15977	0.2165	-0.285	0.3545	-0.2854	0.3545
X Variable 1	0.4895	0.15012	3.2608	0.1889	0.7901	0.1889	0.7901

3.9.1 Testing the Alpha Value

The alpha should not be statistically significant from zero. The beta factor of the market as a whole is 1. A beta greater than 1 suggests the stock is highly volatile compared to the market and vice versa

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.
H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted.
The t-value corresponding to the intercept is 0.2164881, taking 0.05 confidence interval and 59 observations, the t-value corresponding to 0.2164881 is 1.697. From the results we can confidently accept the null hypothesis of zero significance of alpha.

3. 9. 2 Testing the Beta Value

The significance of beta is tested in the hypothesis test below

Testing the Hypothesis

$H_{0:} = \beta = 0$.The null hypothesis is that the market risk or systematic risk (beta) associated with the stock of Infosystch is not statistically significant from zero.

H_1: $\beta > 0$ the alternative hypothesis is that the beta or systematic risk is greater than zero. This is basically a single tailed test of the hypothesis

The Test Significance

The null hypothesis of zero significance of the estimated value of beta is rejected if the t-value calculated by the regression is > table value or = table value, otherwise the null hypothesis is accepted.

The beta-coefficient of Infosystch stock is statistically significant from zero at 0.05% level of confidence. The t-value of 3.2608017 from the regression corresponding to the t-stat of 1.645 is highly significant. The null hypothesis of zero significance of beta is rejected.

From the regression, the beta value of is 0.489507438. Beta indicates the tendency of the stock to respond to swings in the market. A beta of the market portfolio is equal to 1. A security with a beta greater than 1 maybe described as aggressive because it has more risk than the market portfolio. A beta of less than 1 is described as defensive because it has less risk than the market portfolio. The beta of 0.489507438 from the regression suggests that the Infosystch stock is moving with about just half the market risk.

3.9.3 The R Squared

The R Squared that emerges from the regression is 0.157214003 which is approximately 15%. We can verify from the value that only about 15% of the risk factor is systematic From this result it can also be verified that about 85% of the risk factor ,that is 85 %($1-R^2$) is attributed to the unsystematic risk. The low R^2 explains the low beta of the company.

3.9.4 Measuring the Performance Of Infosys Technologies Stock

The performance of Infosystch Ltd over the period 2005 to 2009 will be measured by comparing the risk-adjusted returns to the S&P CNX Nifty. The regression is run on the dependent variable y (the risk-adjusted returns) and the independent variable x (the risk-premium. The general equation for the line is $R_{it} - R_{ft}$=Beta $(M_{rt} - R_{ft}) + \alpha$

Where R_{it} is the stock return rate

R_{ft} is the risk-free rate of return

$(R_{it} - R_f)_{is}$ the risk-adjusted returns

M_{rt} is the return index or market return

$(M_{rt} - R_{ft})$ is the risk premium

B is the beta of the stock

Alpha is the intercept

The table for the variables used in calculating the risk-adjusted returns of Infosystch Ltd for 2005-2009 is found below.

Table 3.11 Showing the Risk-Adjusted Returns, Market Returns, Returns on Infosystch stock and the Risk-Free Rate of Return

Series	Date	Adj Close	Exp. Return (ERK)	Risk Free Rate(rf)	Exp. Ret. (ERP)	Risk Premium (ERP-rf)	Risk-Adjusted Returns
INFOSYST	1/12/2009	2385	0.0038	0.0486	0.4014	0.3529	-0.0448
INFOSYST	3/11/2009	2384.25	0.9187	0.0706	0.8175	0.747	0.84811
INFOSYST	1/10/2009	2214.7	-0.4134	0.0703	-0.8786	-0.949	-0.4836
INFOSYST	1/9/2009	2293.71	0.9797	0.0874	1.0858	0.9984	0.8923
INFOSYST	3/8/2009	2120.58	0.3985	0.0899	0.0664	-0.024	0.30854
INFOSYST	1/7/2009	2052.43	1.9165	0.0915	0.9658	0.8743	1.82501
INFOSYST	1/6/2009	1769.78	1.3803	0.0865	-0.4258	-0.512	1.29379
INFOSYST	4/5/2009	1587.21	0.8596	0.0742	3.3679	3.2938	0.78546
INFOSYST	1/4/2009	1481.11	1.5113	0.0699	1.7994	1.7295	1.44139
INFOSYST	2/3/2009	1315.44	0.9682	0.0445	1.1172	1.0727	0.92365
INFOSYST	2/2/2009	1217.23	-0.7294	0.0448	-0.464	-0.509	-0.7742
INFOSYST	1/1/2009	1296	2.0461	0.0472	-0.3421	-0.389	1.99895
INFOSYST	1/12/2008	1107.21	-1.2425	0.0728	0.8888	0.816	-1.3152
INFOSYST	3/11/2008	1235.09	-1.2149	0.0749	-0.5427	-0.618	-1.2898
INFOSYST	1/10/2008	1374.22	-0.0719	0.073	-3.1692	-3.242	-0.1449
INFOSYST	1/9/2008	1382.5	-2.3726	0.0672	-1.2077	-1.275	-2.4398
INFOSYST	1/8/2008	1723.21	1.2912	0.0675	0.0749	0.0074	1.22368
INFOSYST	1/7/2008	1555.81	-1.015	0.0501	0.8684	0.8183	-1.0651
INFOSYST	2/6/2008	1699.57	-1.5129	0.0699	-2.044	-2.114	-1.5828
INFOSYST	2/5/2008	1944.76	1.7078	0.0644	-0.6871	-0.752	1.6434
INFOSYST	1/4/2008	1702.47	2.6829	0.0737	1.0934	1.0197	2.6092
INFOSYST	3/3/2008	1391.39	-0.7557	0.07	-1.1234	-1.193	-0.8257
INFOSYST	1/2/2008	1484.9	0.0778	0.0717	0.201	0.1293	0.00609
INFOSYST	1/1/2008	1475.34	-1.6658	0.069	-1.9571	-2.026	-1.7348
INFOSYST	3/12/2007	1713.15	1.1963	0.0725	0.7826	0.7102	1.12377
INFOSYST	1/11/2007	1557.85	-1.5326	0.0625	-0.2804	-0.343	-1.595
INFOSYST	1/10/2007	1785.94	-0.2618	0.0652	2.1013	2.0362	-0.327
INFOSYST	3/9/2007	1825.78	0.2076	0.0659	1.4983	1.4324	0.14171
INFOSYST	1/8/2007	1794.73	-0.7336	0.062	-0.1718	-0.234	-0.7957
INFOSYST	2/7/2007	1911.6	0.2908	0.0636	0.5851	0.5215	0.22724
INFOSYST	4/6/2007	1866.37	0.075	0.0628	0.0629	8.00E-06	0.01221
INFOSYST	3/5/2007	1854.77	-0.7452	0.0554	0.6103	0.5548	-0.8006
INFOSYST	2/4/2007	1977.57	0.1914	0.0552	0.8364	0.7812	0.13618
INFOSYST	1/3/2007	1946.53	-0.3402	0.0756	0.2443	0.1687	-0.4157
INFOSYST	1/2/2007	2003.32	-0.9064	0.071	-0.9917	-1.063	-0.9775
INFOSYST	2/1/2007	2167.01	0.0295	0.0729	0.3519	0.2789	-0.0435
INFOSYST	1/12/2006	2161.7	0.3419	0.0606	0.0861	-0.024	0.28133
INFOSYST	1/11/2006	2101.82	0.4822	0.0566	0.6743	0.6178	0.42559
INFOSYST	3/10/2006	2020.63	1.6279	0.0548	0.5207	0.4658	1.57306
INFOSYST	1/9/2006	1779.26	0.2873	0.0515	0.6134	0.5619	0.2358
INFOSYST	1/8/2006	1737.66	1.0934	0.0513	1.0335	0.9822	1.04213
INFOSYST	3/7/2006	1592.55	-5.5476	0.0531	0.0575	0.0044	-5.6007

INFOSYSTCH	1/6/2006	2961.78	0.2079	0.0536	-0.2151	-0.269	0.15434
INFOSYSTCH	1/5/2006	2911.33	-0.2486	0.0516	-1.1042	-1.156	-0.3002
INFOSYSTCH	3/4/2006	2972.93	0.609	0.0516	0.3723	0.3207	0.55741
INFOSYSTCH	1/3/2006	2829.35	0.6467	0.061	1.2795	1.2185	0.58569
INFOSYSTCH	1/2/2006	2684.67	-0.214	0.0665	0.2943	0.2278	-0.2805
INFOSYSTCH	2/1/2006	2738.41	-0.4567	0.066	0.6961	0.6302	-0.5326
INFOSYSTCH	1/12/2005	2844.01	1.3965	0.0533	0.8339	0.7806	1.3432
INFOSYSTCH	1/11/2005	2547.54	0.7732	0.0519	1.4237	1.3718	0.7213
INFOSYSTCH	3/10/2005	2398.33	0.0618	0	-1.063	-1.063	0.06184
INFOSYSTCH	1/9/2005	2381.06	0.703	0.0479	1.0907	1.0428	0.6551
INFOSYSTCH	1/8/2005	2249.29	0.5695	0.0451	0.3755	0.3304	0.52441
INFOSYSTCH	1/7/2005	2147.38	-0.457	0.0447	0.4955	0.4509	-0.5016
INFOSYSTCH	1/6/2005	2232.39	0.6112	0.0437	0.7648	0.7211	0.56751
INFOSYSTCH	2/5/2005	2124.19	2.3128	0.0438	1.1672	1.1234	2.26899
INFOSYSTCH	1/4/2005	1780.94	-1.9692	0.0436	-0.7849	-0.829	-2.0128
INFOSYSTCH	1/3/2005	2130.56	0.0916	0.0515	-0.3857	-0.437	0.04007
INFOSYSTCH	1/2/2005	2114.42	0.9946	0.0504	0.2662	0.2158	0.94411
INFOSYSTCH	3/1/2005	1952.59		0.0514	1	0.9486	-0.0514

Average of the Returns of Company, Market Returns, Risk Premium and Risk Free Rate in Percentages

Series	Date	Average Adj. Closing	Average Exp. Ret (%)	Avg Risk Free Rate (%)	Average Market Ret. (%)	Average Risk Premium (%)	Average Risk-Adj Ret.(%0
INFOSYSTCH	2005 - 2009	1966.3	12.07	6.0	24.9	18.8	5.81

The regression would be run to determine the significance of the intercept. An intercept of zero would indicate actual returns equal expected returns. If the intercept is greater than zero, we can determine if the stock is receiving returns from unsystematic risk as well as systematic risk.

Testing the Hypothesis

H_0=0 the null hypothesis: The intercept is not statistically significant from zero.
H1> 0 the alternative hypothesis: The intercept is statistically significant from zero

The Test Significance

The null hypothesis of zero significance of alpha is rejected if the t-value from the regression results is > table value or = table value, otherwise the null hypothesis is accepted. The t-value corresponding to the 0.1640555 at 0.05 level of confidence with 59 degrees of freedom, the t-table value corresponding to 0.1640555 is 1.697.

Fig 3.17 Summary results of Regression to determine the alpha coefficient and its significance.

Regression Statistics	
Multiple R	0.39657
R^2	0.15727
Adj R^2	0.14249
Std Error	1.20963
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	15.5648	15.565	0.0019
Residual	57	83.4027	1.4632	
Total	58	98.9675		

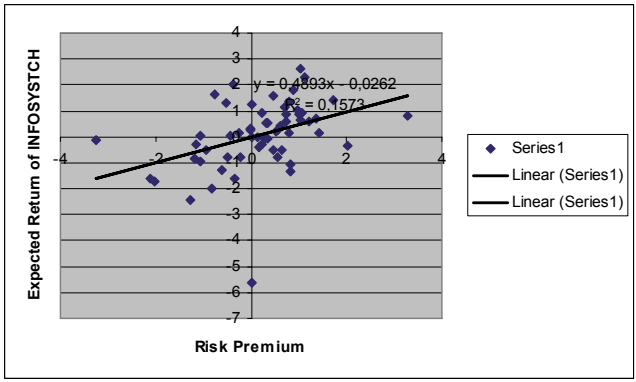
	Co-effi	*Std Error*	*t Stat*	*Low95%*	*Up 95%*	*Low95.0%*	*Up 95.0%*
Intercept	-0.02628	0.15968	-0.1641	-0.346	0.294	-0.346	0.2936
X Variable 1	0.48933	0.15003	3.2615	0.1889	0.79	0.1889	0.7898

The null hypothesis of zero significance of alpha is accepted, this implies that the returns from the stock is determined by the systematic risk. This supports CAPM that there are no returns for non-systematic risk.

Graphically, the Information can be presented in a scatter diagram.

3.9.5 Scatter Diagram for Infosystch Stock

Fig 3.18 Scatter diagram showing the performance of Infosystch Ltd stock for 2005 to 2009



The points on the graph show the risk-adjusted returns and the index for Infosystch for the period 2005 to 2009. The equation of the line provided is y = 0.48933x -0.026196 where 0.48933 is the slope and 0.026196 is the intercept. The R^2 of 0.1572715 shows that about 15% of the stocks returns is explained by the exposure to systematic risk. The high R squared also indicates the stock's performance has been in line with the index.

3.9.6 The Jensen's Alpha tests for Infosystch

The Jensen's alpha would be used to measure the performance of Infosystch stock. The measure would be to find out if the stock earned higher returns than other companies having similar betas.

Fig. 3.19 Summary results of Regression to determine Jensen's alpha on InfosysTechnologies Stock

Regression Statistics	
Multiple R	0.397142
R^2	0.157722
Adj R^2	0.142945
Std Error	1.209964
Obs	59

ANOVA

	df	*SS*	*MS*	*Significance F*
Regression	1	15.626	15.626	0.00184
Residual	57	83.449	1.464	
Total	58	99.075		

	Co-effic	*Std Error*	*t Stat*	*Low95%*	*Up 95%*	*Low95.0%*	*Up 95.0%*
Intercept	0.004663	0.1615	0.0289	-0.3187	0.328	-0.319	0.328
X Variable 1	0.490164	0.15	3.2671	0.18973	0.7906	0.1897	0.7906

A simple linear regression is run from the data in table to determine the intercept. The dependent variable is the stock returns and the independent variable, the market returns.

The intercept from the regression is 0.00466327. The beta of the stock from the initial regression is 0.489507438. The Jensen's alpha can

be found by first finding R_f (1- β) which is 0.060816(1-0.489507438) = 0.031046116. The Jensen's alpha is

The result of the intercept α- R_f (1- β) which is 0.00466327 - 0.031046144. That is -0.02638287.

From the analysis, we also find that $\alpha < R_f$ (1- β), which means that Infosystch Ltd. From the analysis we also find out that $\alpha < R_f$ (1- β),i.e -0.0664159 < -0.044648568, which means Infosystch did not earn returns than companies of similar beta.

3.9.7 Analysis of Results of Infosys

The t-stat value of 3.26705162 corresponding to the beta value of 0.49016403 is highly significant. The beta shows the tendency of the stock to respond to swings in the market. The beta value of 0.49016403 indicates that the Infosystch moves with only half of the market risk. This may be due to the fact that Infosystch may be having significant specific risk other than the market risk. During the period of this study, the average returns for Infosystch have been about 12%.

CHAPTER FOUR

SUMMARY, FINDING AND CONCLUSION

4.1 Summary

The empirical test of the Capital Asset Pricing Model is the focus of this study. The study uses monthly data of 5 individual stocks, from 5 companies listed on the National Stock Exchange of India during the period January 2005 to December 2009. These companies are the State Bank of India, Tata Motors, Infosys Technologies Ltd, HDFC Bank and the Reliance Group of Companies. The test was to estimate beta for the individual stocks using stock price observations to run a regression on the monthly rate of returns of these stock prices.

The performance of the companies was also observed by looking at alpha coefficient of the companies apart from systematic risk.
The Jensen's alpha was also used to determine the performance of the companies by comparing their returns to companies of similar betas.

4.2 Findings of the study

The performance and observation of these companies are presented in a table form below.
Table 4.1. Is Showing the Estimate of Stock's Alpha and Beta Coefficients, R Square and Returns during the Regression Period 2005 to 2009

SYMBOL	Alpha Coefficients (t-static)	Beta Coefficients (t- static)	R Squares (Percentages)
SBIN	0.13696 (0.98735)	1.1695 (8.978022)	0.578503 (57%)
HDFC	0.1166991 (0.93209696)	1.18239744 (10.0514079)	0.63931082 (63%)
RELIANCE	0.09701 (0.6209929)	0.9379132 (6.3900243)	0.41737099 (41%)
TATA MOTORS	0.01671781 (0.10500161)	1.3591539 (9.07734775)	0.59109985 (59%)
INFOSYSTCH	0.034589048 (0.2164881)	0.89507438 (3.2608017)	0.157214003 (15%)

From the study, we find out that the beta or systematic risk of most of the companies is significant at 5% level of confidence. This means that the market has an influence on the stocks beta. Beta is therefore a good measure of the risk.

The beta of the market as a whole is equal to 1. Some of the stocks are risky while others are less risky. The range of estimated stock betas for the five companies is between 0.489507488 the minimum for Infosystch and 1.359839, the maximum for Tata Motors. All the beta coefficients for individual stock are statistically significantly different from zero. State Bank of India, HDFC Bank and Tata Motors have a beta value of more than 1.This means the stock are more volatile than the market. The investors who have a high appetite for risk, risk-loving investors would mostly prefer to purchase stocks from these 3 companies.

Reliance has a beta very close of 1 and we can verify from this that the Reliance stock is as small or large as the market portfolio. Infosystch also has a beta half that of the market. Investors with a low appetite for risk, risk-averse individuals,would prefer stocks from these two companies.

The proportion of risk covered by beta is explained from the R squared. The proportion of risk covered by beta for State Bank of India, Tata Motors and HDFC Bank is higher than 50% thus beta explains the model in a proportion greater than 50% for these companies.

On the other hand, Reliance and Infosystch have an R Square of less than 50% therefore we can conclude that beta explains the model in a proportion less than 41% and 15% for Reliance and Infosystch respectively.

Beta in the case of the 5 companies can be said to measure relatively the correct systematic risk of the stocks.

4.2.1 Finding in general: **Beta, Actual Return, Expected Return, and Required Return for all companies in our study**

The theory indicates that higher market risk (beta) is associated with higher market returns.

The table below compares the beta and actual returns, and expected returns of the five companies.

Company	Beta	Actual Return	Expected Return	Required Return
SBN	1.1695	40%	20.59	26.57
HDFC	1.18239	32%	20.47%	26.45%
Tata Moto	1.1591	25.50%	20.05	26.03
INFOSYST	0.490164	12%	8.48%	14.46
RELIANCE	0.9379	26.20%	8.47%	14.45

Average for the period

The expected return for the companies are the averages of the ß s multiplied by the excess return of the market over the risk free rates, where the ß s are only the different for different companies (same for one company).The actual returns are the per cent age changes in stock prices of each companies, which is a standard way of finding returns . As mentioned already the ßs mostly determine the expected returns. The last column is the required rate of return where the average risk free rate is added to the expected excess return.. For State Bank Of India, HDFC, and Tata Motors, the expected return and the required returns are higher , for Infosystch, and Reliance they are relatively lower. It means that the

former three companies have more market risks. But the actual return for Reliance is not lower. Expected excess return, given above in the fourth column is the equity risk premium. Those equity risk premiums are found to be very high for India compared to the equity premium in developed countries. We may adjust for the fact that by multiplying by twelve the monthly return to get the annual return may be exaggerating those figures to some extent as unlike the money markets in stock markets the dividends are not being paid every quarter and trend increase in return will not happen as the efficient market hypothesis tells us. Even adjusting for those factors, still the equity premiums are higher for India.

We can also observe that the expected return (which is supposed to be the unconditional mean expected return) is lower than the actual return(which can be conditional mean return) in all the cases. In this context we may refer to Fama E.F,and French.K.R.(2002) findings and conclusions that though for a very long run period of 1872 to 2000 the expected returns , which they proxy as the dividend yields plus the growth rate of dividends , approximates to the dividends yields plus the capital gain /loss for the stocks, for more recent periods of 1951 to 2000 ,the expected returns constructed from the former is much lower than the actual capital gains /actual returns of the stocks ,or there is a much higher equity risk premium in the recent periods.

The positive relationship between beta and actual returns may not be true for all the companies. For instance, Tata Motors has one of the high beta, but yields a lower actual return compared to the State Bank of India, Reliance and HDFC Bank.

CAPM debates that there is a positive relationship between risk and return. If we look at the beta and returns, we notice that the risk is related to the returns and CAPM has passed the test. However, the power of beta as estimate for risk is not high due to the R Squared especially for Infosystch and Reliance.

All estimated alpha values for the five companies are not statistically significant different from zero. This provides evidence in favour of CAPM that there are no returns for unsystematic risk.

The Jensen's alpha was also used to measure the performance of the companies. State Bank of India and HDFC Bank (representing the banking sector for the study) gave positive Jensen's alpha and these banks performed better than companies of similar betas. Tata Motors (representing the automobile sector) had a very high beta but did not perform better than companies of similar betas. Reliance Group of Companies (representing the oil and gas sector) had a beta same as the market portfolio and performed better than companies of similar betas. Infosystch (representing the Information Technology Sector) had a low beta and did not perform better than companies having similar betas

Certain aspects of the test may not fully support the CAPM due to the following reasons. There were errors in the test because a proxy was used to represent the actual market returns. There is no risk free rate of return asset in the market. A proxy was also used to represent the actual market returns given and this may cause bias in the information given.

According to the assumptions of the CAPM, the market portfolio represents a combination of risky assets that are preferred universally.[40] This implies that the market portfolio should ideally include all assets. But naturally for the purpose of testing the CAPM, only a reasonable proxy for the market portfolio is used. If the market proxy is therefore not clearly defined, as may be the case of developing markets such as India, the test of the CAPM using information from this proxy may give misleading results. The construction of the market index may sometimes involve some problems, because unlike developed countries, Indian Capital Market is relatively new and growing. The inadequacies in the infrastructure may be one of the reasons for the inconsistencies in the data not fully explaining the CAPM.

In developing countries such as India, the assumptions of the CAPM may not be completely valid, because, security trading may not be so efficient in terms of faster and easier availability of information, greater transparency in transactions, less transaction cost among others, a well diversified portfolio ,as compared to developed countries.

[40] Cornelius A. Hotman. Market Portfolio Selection when using Capital Asset Pricing Model, International Advances of Economic Research., May 1998,Vol.4, No.2 . Page 204.

4.3 Conclusions

The study conducted on the five companies listed on the Indian Stock Exchange shows that the Capital Asset Pricing Model satisfactorily explains the risk-return relationship in the Indian Stock Market.

The theory according to the study is acceptable in India and would be a useful tool to investors in their decision making process to invest in any of the stock that was studied in this write up. The risk and expected return posed to any investor who wishes to invest in any of the companies studied is made available.

.Non- market risk can be diversified away and that does not require expected return and only the market risk explains the expected risk according to CAPM. And generally, Indian share holders might have diversified equity portfolios. However, in a few cases, it has been found out that market risk alone can not explain the required return demanded by share holders., but it does not constitute enough evidence in support of an alternative model.

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