Research on Capital Asset Pricing Model Empirical in Indian Market

Amit Kundu, C.K. Mukhopadhyaya

Abstract: ***The main purpose of this study is to empirically investigate the applicability of CAPM for some selected stocks listed in the Bombay Stock Exchange (BSE) over the period January, 2014 – August, 2015. The study shows that CAPM held good completely for 16 stocks. So CAPM was not found to be applicable to all the stocks under study.***

Keywords: CAPM, Systematic Risk, Skewness, Jarque-Bera Test, Jensen Statistics, Co integration, Stationary.

I. INTRODUCTION

CAPM is the first equilibrium model on the capital asset pricing. CAPM also can do the quantitative inspection. The primary significance of the model is to establish the relationship between risk and return of capital, clearly indicating the expected return of securities is the sum of risk-free rate of return and risk compensation, which reveals the internal structure of securities compensation. The capital asset pricing model (CAPM), developed by William F. Sharpe and John Lintner, uses the beta of a particular security, the risk-free rate of return, and the market return to calculate the required return of an investment to its expected risk.

Required Return = Risk-Free Rate+ Risk Premium

= Risk - Free Rate + [Beta x (Market Return- Risk Free Rate)]

The Capital Asset Pricing Model (CAPM) calculates the expected return on equity of an individual company. It is based on the expected rate of return on the market, the risk-free rate and the beta coefficient of an individual security or portfolio.

$$E(R_i) = R_f + \beta[E(R_m) - R_f]$$

Where,

$E(R_i)$: Expected rate of Return on Equity

R_f: risk-free rate

$E(R_m)$: expected rate of return on market, and

β: **beta** coefficient.

$E(R_m)-R_f$: the difference between the expected market rate of return and the risk-free rate, is known as the market premium**.**

Total risk to a stock can be divided into two parts: systematic rate (the risk associated with market and cannot be diversified away) and unsystematic risk (The risk inherent to the stock and can be eliminated through diversification). Beta is a measure of systematic risk of a stock. Beta describes the sensitivity of a stock's returns to the changes in the market. An asset with a beta of zero means its return is independent of changes in the market return.

Beta = Covariance of stock to the market / Variance of the market

The Security Market Line (SML) is essentially a graph representation of CAPM formula. It plots the expected return of stocks on the y-axis, against beta on the x-axis. The intercept is the risk free rate and the slope represents the market premium. Individual securities' expected return and risk are plotted on the SML graph. For one security, if it is plotted above the SML, it is undervalued as the investors are expecting a greater return for the same amount of risk (beta). If it is plotted below the SML, it is overvalued as the investors would accept a lower return for the same amount of risk (beta).

Important significance of CAPM is that it divided risks into unsystematic risk and systemic risk. Unsystematic risk is the risk that belongs to some particular companies or specific industry; it can be dispersive through asset diversification. Systemic risk refers to the inherent risk factors that affect the whole market. It intrinsic exists in the stock market and this risk cannot be eliminated through diversification. The function of CAPM is to use the assets portfolio to eliminate unsystematic risk; the systematic risk is the only one remains. β coefficient has been introduced in the model to characterize the systemic risk.

In reality, many studies questioned the validity of the CAPM, but it is still widely used in the investment community. Although the change of individual stocks is difficult to be predicted through β, but investors still believe that equity portfolio with bigger β value has bigger volatility than the market price, regardless of market prices rise or fall; while equity portfolio with smaller β value has smaller volatility than the market price. This point is very important for investors. When the market prices declines, they can invest in a low β value stocks. And when the market rises, they can share a β value of the investment is bigger than 1. CAPM is not a perfect model, but it is correctly analysis of the problem. It provides a model can measure the size of the risk, to help investors determine whether the excess return obtained matches the risk among.

II. LITERATURE SURVEY

Don U.A. Galagedera (November 2014) in "A Review of Capital Asset Pricing Models" dealt with individual security returns and examined the risk-return relationship. His multifactor models were virtually extended forms of the Capital Asset Pricing Model (CAPM) with higher order co-moments and asset pricing models conditional on time-

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varying volatility. He held that an inverse relationship between beta and portfolio returns might be expected, when the market return fell short of risk free return such that the risk premium emerged negative, an inverse relationship between beta and portfolio returns is expected. Jianhua Dai, Jian Hu and Songmin Lan (2014) in "Research on Capital Asset Pricing Model: Empirical in China Market" examined the CAPM in China's Stock markets. Stock data and combined data of Shanghai Stock Exchange were used in the study. Empirical analysis of these data had been carried out by way of t-statistics and joint test to verify if CAPM model would be true for China's stock market. They concluded that CAPM model was essential feature in China's stock market. Thus, CAPM model can be applied in empirical analysis.

Michael C. Jensen & Myron Scholes (1972) in "The Capital Asset Pricing Model: Some Empirical Tests" sought to develop portfolio evaluation models and measure the relation between the expected risk premiums on individual assets and their systematic risk. Their study involved capital asset pricing model, Cross-sectional Tests, Two-Factor Model, and aggregation problem. They reported that the expected excess return on an asset was not strictly proportional to its Beta. M. Srinivasa Reddy, S. Durga (2015) in "Testing the Validity of CAPM in Indian stock markets" examined the relationship between risk and expected return of securities. This paper tested the CAPM for the Indian stock market using Black Jensen Scholes methodology. The sample involves 87 stocks included in the Nifty and Nifty Junior indices from 1st Jan 2005 to Aug 2014. The test was based on the time series regressions of excess portfolio return on excess market return. The results show that CAPM partially held in Indian markets over the period of study. Sylvester Jarlee (2007) in "A Test of the Capital Asset Pricing Model: Studying Stocks on The Stockholm Stock Exchange" over the period January 2001 - December 2006 employed tools like CAPM, Time-series test, Cross-sectional test. The study did not fully uphold the CAPM. Further the study did not provide evidence that higher beta yielded higher return while the slope of the security market line was negative and downwards sloping. However, a linear relationship between beta and return was established.

Theriou. N, Aggelidis. V, and Spiridis. T (2001) in "Empirical Testing of Capital Asset Pricing Model" examined if there did exist any linear relation between risk and portfolio returns over the period July 1992 to the June 2001. This study involved the use of CAPM, beta, cross-section of returns and two-factor model. They concluded that the traditional CAPM was not confirmed in the ASE for the period of study between the July1992, June2001. Tom A. Fearnley (2002) in "Estimation of an International Capital Asset Pricing Model with Stocks and Government Bonds" investigated if US, Japanese and European stocks and government bond returns were linearly related. He further sought to explore the time variation of the price of market risk for a structural change in the prices of market and currency risk. Study was carried out with International CAPM and Multivariate GARCH. He found that CAPM held better for the stock markets than for the bond markets.

III. OBJECTIVE OF THE STUDY

The objective of this study is to empirically investigate the applicability of CAPM for some selected stocks listed in the Bombay Stock Exchange (BSE) over the period January, 2014 – August, 2015.

Data:

The study involves the use of daily stock closing prices of 30 selected stocks listed in the Bombay Stock Exchange (BSE) for the period January, 2014-August, 2015. The data have been collected from the official website of the Bombay stock Exchange (www.bseindia.com). The risk-free asset has been proxied by the 91-day Treasury Bill & data on the risk-free rates for the relevant period were obtained from the RBI Bulletin, a publication of RBI.

IV. METHODOLOGY

Section I

The Market Model, developed by Sharpe (1964), holds that most shares maintain some degree of positive correlation with market portfolio. When market rises, most shares tend to rise. Sharpe postulated a linear link between a security return and the market return as a whole such that the excess return on a security is linearly and proportionately related to the excess return on the market portfolio. Let us consider a security ***i*** with expected return $E(R_i)$. Then for any risk free return (R_t^*), CAPM definition is that

$$E(R_{it}) - R_t^* = \beta_i [E(R_{mt}) - R_t^*] \quad \text{---------- (1)}$$

Where $E(R_i)$ =expected rate of return on security ***i***

R_t^* =risk free rate of return

$E(R_m)$ =expected rate of return on the market portfolio

$E(R_{it}) - R_t^*$=the excess of rate of return on security ***i*** over the risk free rate of return

= the risk premium for the security ***i***

$E(R_{mt}) - R_t^*$ =the expected rate of market return over the risk free rate

=the market premium

β_i =the sensitivity of the risk premium of the security ***i*** to the market premium

Therefore, the equation (1) states that the risk premium for any individual security (*i*) equals the market premium times the corresponding β_i.

Thus according to Sharp's model, the only common factor affecting all securities is the market rate of return. All other factors, like dividend yields, price-earning ratios, quality of management and industrial features bear no separate influence on $E(R_{it})$.

Section II

Estimation and Findings

I) Stationarity, Integrebility and Contegration

Series of excess returns on securities $(R_{it} - R_t^*)$; R_{it} ; i = 1,… ,30 of 30 different companies and market return series ($R_{mt} - R_t^*$) have been subject to ADF Unit Root Tests for examining stationarity and determining integrability of the

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series concerned. Results of such tests have been presented below.

It is observed that

$(R_{it} - R_t^*) \sim I(0)$ *and* $(R_{mt} - R_t^*) \sim I(0)$.

Consequently, $(R_{it} - R_t^*) = Y_t \sim I(0)$ and $(R_{mt} - R_t^*) = X_t \sim I(0)$ are *cointegrated.* The estimable *cointegrating eqation* is

$$Y_t = \alpha + \beta X_t + u_t \quad \text{---------- (9)}$$

where $u_t \sim tidN(0, \sigma_u^2)$

Results of estimation of the equation (9) for securities of 30 different companies are being presented below in Table-1.

Table 1. Estimated Cointegration Equations for the Selected Stocks

Stock Name	1/2014 to 8/2015	Estimate	Std. Error	t value	Pr(>|t|)
Jindal	*Slope(β)*	1.491291	0.177262	8.412911	0.0000
	Intercept Term	-0.328509*	0.153638	-2.138201	0.0331
	R-squared =0.1497, Adjusted R-squared = 0.1476, F-Stat=70.777 & Pro(0.0000), Durbin-Watson stat=2.104715				
Bharat Petrolium	*Slope(β)*	0.188842	0.093534	2.018979	0.0442
	Intercept Term	1.152915*	0.107916	10.68347	0.0000
	R-squared =0.2212, Adjusted R-squared = 0.2191, F-Stat=114.13 & Pro(0.0000), Durbin-Watson stat=2.0425				
Cipla Ltd.	*Slope(β)*	0.826934	0.088482	9.345799	0.0000
	Intercept Term	0.080753	0.076690	1.052987	0.2930
	R-squared =0.178, Adjusted R-squared = 0.176, F-Stat=87.34& Pro(0.0000), Durbin-Watson stat=1.930				
Coal India Ltd.	*Slope(β)*	1.008280	0.103400	9.751239	0.0000
	Intercept Term	-0.003552	0.089620	-0.039639	0.9684
	R-squared =0.1912, Adjusted R-squared = 0.1892, F-Stat=95.08 & Pro(0.0000), Durbin-Watson stat=2.019				
GAIL	*Slope(β)*	0.972423	0.092627	10.49822	0.0000
	Intercept Term	-0.075650	0.080283	-0.942293	0.3466
	R-squared =0.215, Adjusted R-squared = 0.213, F-Stat=110.21 & Pro(0.0000), Durbin-Watson stat=2.077				
HDFC Mutual Fund	*Slope(β)*	-0.132183	0.045076	-2.932481	0.0036
	Intercept Term	-0.112463*	0.039068	-2.878630	0.0042
	R-squared =0.020, Adjusted R-squared = 0.018, F-Stat=8.599 & Pro(0.0000), Durbin-Watson stat=2.348				
HDFC	*Slope(β)*	0.976425	0.050652	19.27701	0.0000
	Intercept Term	0.055133	0.043902	1.255838	0.2099
	R-squared =0.480, Adjusted R-squared = 0.479, F-Stat=371.6& Pro(0.0000), Durbin-Watson stat=2.094				
Hero Motocorp	*Slope(β)*	0.783786	0.082198	9.535281	0.0000
	Intercept Term	-0.007875	0.071244	-0.110530	0.9120
	R-squared =0.184, Adjusted R-squared = 0.182, F-Stat=90.92 & Pro(0.0000), Durbin-Watson stat=1.962				
Hindalco	*Slope (β)*	1.429763	0.123670	11.56109	0.0000
	Intercept Term	-0.116398	0.107188	-1.085924	0.2782
	R-squared =0.249, Adjusted R-squared = 0.247, F-Stat=133.6 & Pro(0.0000), Durbin-Watson stat=1.945				
Kotac Mahendra	*Slope(β)*	0.956382	0.084629	11.30091	0.0000
	Intercept Term	0.105869	0.073350	1.443344	0.1497
	R-squared =0.241, Adjusted R-squared = 0.239, F-Stat=127.7& Pro(0.0000), Durbin-Watson stat=2.00				
Larsen	*Slope(β)*	1.349090	0.072341	18.64896	0.0000
	Intercept Term	0.073443	0.062700	1.171336	0.2422
	R-squared =0.463, Adjusted R-squared = 0.462, F-Stat=347.7& Pro(0.0000), Durbin-Watson stat=1.942				
Lupin	*Slope(β)*	0.498066	0.088972	5.598032	0.0000
	Intercept Term	0.114449	0.077114	1.484145	0.1386
	R-squared =0.072, Adjusted R-squared = 0.07.462, F-Stat=31.3& Pro(0.0000), Durbin-Watson stat=1.84				
Maruti Suzuki Ltd	*Slope(β)*	0.893986	0.078709	11.35812	0.0000
	Intercept Term	0.178684*	0.068219	2.619255	0.0091

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	R-squared =0.24, Adjusted R-squared = 0.24, F-Stat=129. & Pro(0.0000), Durbin-Watson stat=2.0359				
Oil & Natural GasCorporation Ltd	*Slope(β)*	1.208637	0.098120	12.31797	0.0000
	Intercept Term	-0.073537	0.085043	-0.864698	0.3877
	R-squared =0.27, Adjusted R-squared = 0.27, F-Stat=151.7. & Pro(0.0000), Durbin-Watson stat=2.09				
ACC	*Slope(β)*	1.068712	0.077224	13.83906	0.0000
	Intercept Term	0.005557	0.066932	0.083018	0.9339
	R-squared =0.322, Adjusted R-squared = 0.32, F-Stat=191.5. & Pro(0.0000), Durbin-Watson stat=2.07				
ICICI Bank	*Slope(β)*	1.540072	0.069422	22.18418	0.0000
	Intercept Term	0.031523	0.060170	0.523898	0.6006
	R-squared =0.55, Adjusted R-squared = 0.54, F-Stat=492& Pro(0.0000), Durbin-Watson stat=1.80				
Punjab National Bank	*Slope(β)*	0.956382	0.084629	11.30091	0.0000
	Intercept Term	0.105869	0.073350	1.443344	0.1497
	R-squared =0.24, Adjusted R-squared = 0.23, F-Stat=128 & Pro(0.0000),,Durbin-Watson stat=2.00				
Reliance Industries Ltd	*Slope(β)*	1.186292	0.065997	17.97504	0.0000
	Intercept Term	-0.047838	0.057201	-0.836321	0.4035
	R-squared =0.445, Adjusted R-squared = 0.44, F-Stat=323. & Pro(0.0000), Durbin-Watson stat=2.00				
State Bank Of India	*Slope(β)*	1.464829	0.084182	17.40083	0.0000
	Intercept Term	0.061577	0.072962	0.843956	0.3992
	R-squared =0.429, Adjusted R-squared = 0.428, F-Stat=302. & Pro(0.0000), Durbin-Watson stat=1.85				
Wipro Ltd	*Slope(β)*	0.513852	0.083598	6.146707	0.0000
	Intercept Term	-0.053684	0.072457	-0.740911	0.4592
	R-squared =0.085, Adjusted R-squared = 0.083, F-Stat=38. & Pro(0.0000),Durbin-Watson stat=2.000				
Sun Pharmaceutical Industries Ltd	*Slope(β)*	0.571438	0.109505	5.218390	0.0000
	Intercept Term	0.067185	0.094911	0.707881	0.4794
	R-squared =0.063, Adjusted R-squared = 0.061, F-Stat=27. & Pro(0.0000),,Durbin-Watson stat=1.90				
Tata Power Company Ltd	*Slope(β)*	1.328889	0.099190	13.39744	0.0000
	Intercept Term	-0.102110	0.085939	-1.188166	0.2355
	R-squared =0.308, Adjusted R-squared = 0.306, F-Stat=179. & Pro(0.0000), Durbin-Watson stat=2.23				
Tata Consultancy Services Ltd	*Slope(β)*	0.507712	0.082535	6.151483	0.0000
	Intercept Term	-0.010839	0.071535	-0.151519	0.8796
	R-squared =0.08, Adjusted R-squared = 0.08, F-Stat=37. & Pro(0.0000),,Durbin-Watson stat=2.00				
TIC	*Slope(β)*	0.649577	0.080296	8.089813	0.0000
	Intercept Term	-0.056089	0.069594	-0.805935	0.4208
	R-squared =0.140, Adjusted R-squared = 0.137, F-Stat=65. & Pro(0.0000),Durbin-Watson stat=1.83				
Asian Paints	*Slope(β)*	0.845973	0.089159	9.488404	0.0000
	Intercept Term	0.086164	0.077276	1.115016	0.2655
	R-squared =0.182, Adjusted R-squared = 0.180, F-Stat=90. & Pro(0.0000),Durbin-Watson stat=2.11				
Hidustan Unilever	*Slope(β)*	0.413503	0.083168	4.971892	0.0000
	Intercept Term	0.041107	0.072084	0.570270	0.5688
	R-squared =0.057, Adjusted R-squared = 0.055, F-Stat=24. & Pro(0.0000),Durbin-Watson stat=1.95				
Infosys	*Slope(β)*	0.508398	0.092280	5.509319	0.0000
	Intercept Term	0.008355	0.079981	0.104467	0.9169
	R-squared =0.07, Adjusted R-squared = 0.06, F-Stat=30 & Pro(0.0000),Durbin-Watson stat=1.99				
M&M	*Slope(β)*	0.931895	0.088454	10.53535	0.0000
	Intercept Term	0.028859	0.076666	0.376430	0.7068
	R-squared =0.216, Adjusted R-squared = 0.214, F-Stat=110& Pro(0.0000), Durbin-Watson stat=2.12				
Tata Steel	*Slope(β)*	1.464829	0.084182	17.40083	0.0000

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	Intercept Term	0.061577	0.072962	0.843956	0.3992
	R-squared =0.429, Adjusted R-squared = 0.428, F-Stat=302 & Pro(0.0000),,Durbin-Watson stat=1.85				
Tata Motors	*Slope(β)*	1.392972	0.087182	15.97773	0.0000
	Intercept Term	-0.069279	0.075563	-0.916830	0.3598
	R-squared =0.39, Adjusted R-squared = 0.39, F-Stat=255 & Pro(0.0000),,Durbin-Watson stat=2.13				

* represents significance at 5% level

Findings:

It has been observed from Tables 1 that

(i) (a) R^2 value in each of the estimated equations is low. Yet F values, which are significant at 1% level, indicate that the estimated equations are good fit, confirming linear relationship between individual risk premium and market risk premium.

(b) DW statistics indicate that residuals are white noise and the estimations are free from autocorrelation.

(ii) Average return for 7 of the 13 companies are found to be negative over the period of studies. These companies are Jindal, Gail, HDFC Mutual Fund, Hindalco, ONGC, Tata Power Company Ltd. and Tata Motors. For these companies Risk-Return relationship is found to be negative except for HDFC Mutual Fund.

(iii) $\hat{\alpha}$ is not statistically significant (even for 5% level) for securities of 26 companies. However, $\hat{\alpha}$ is statistically significant (at 5% level) for securities of four companies like Jindal, Bharat Petrolium, HDFC Mutual Fund and Maruti Suzuki Ltd. Therefore, α = 0 assumption behind CAPM does not strictly hold for securities of these four companies. However, this assumption behind CAPM holds for the rest 26 companies.

(iv) $\hat{\beta}$ is significant even at 1% level for the returns of all the companies concerned. Therefore, *cointegration* between security returns and market returns are established implying that variation in security risk premium is linearly related to market risk premium, given that corresponding residuals are I(0).

(v) However, in case of 26 companies for which $\hat{\alpha}$ statistically insignificant (even at 5% level), the relationship is *Homogenous of degree one* as suggested by the CAPM. On the other hand, in case of 4 companies, as cited above, for which $\hat{\alpha}$ is statistically significant (at 5% level), the relationship between security risk premium and market risk premium is not strictly *Homogenous of degree one.* Thus for these 4 companies CAPM does not hold strictly.

(vi) (a) $|\hat{\beta}| > 1$ for security returns of 12 companies. These companies are Jindal, Coal India Ltd, Hindalco, Larsen, Oil and Natural Gas Corporation Ltd, ACC, ICICI Bank, Reliance Industries Ltd, State Bank of Inda, Tata Power Company Ltd, Tata Steel, Tata Motors. Since $|\hat{\beta}| > 1$ implies that $\sigma_i \rho_{im} > \sigma_m$, stocks of these companies are more volatile than market portfolio. These stocks, therefore, act as '*Aggressive Securities*'.

(b) $|\hat{\beta}| < 1$ for the remaining 18 companies. Since $|\hat{\beta}| < 1$ implies that $\sigma_i \rho_{im} < \sigma_m$, these stocks are less volatile than the market portfolio. These stocks, if included into any portfolio, help stabilize the portfolio. Consequently, these stocks act as **'***Defensive Securities'*.

Section II

Study of Regression Residuals

We have 30 different estimated *cointegrating equations* for 30 different companies. Each estimated *cointegrations equation* entails a series of residuals

$[e_{it}; i = 1,2, \dots, 30]$

Now $e_{it} = Y_{it} - \hat{Y}_{it} = (R_{it} - R_t^*) - [E(R_{it}) - R_t^*]$

$= R_{it} - E(R_{it})$

Thus each element in the e_{it} series represents the deviation between the actual rate of return and the expected rate of return on any security at any period of time. In case of daily data series, daily rate of return on any security (*i*) may deviate from the daily expected rate of return, and such deviation constitutes e_{it} for the day.

Series of e_{it} over the entire period of study presents the residual series for the security concerned. In such series for some days $e_{it} > 0$ folowing $R_{it} > E(R_{it})$ and it implies that for these days the stock was '*under-valued*'. Again for some other days $e_{it} < 0$ following $R_{it} < E(R_{it})$ implying that for these days the stock was '*over-valued*'.

It, therefore, becomes pertinent to confirm the '*overall status*' of the stock i.e., if the stock, by and large were '*overvalued*' or '*undervalued*' over the period concerned. The study of residuals helps determine the '*overall status*' of the residuals concerned.

It may be noted that $u_t \sim iidN(0, \sigma_u^2)$ is *Gausian White-noise*. In this case the study relates to examining deviation of residuals from Gaussian white noise property. The residual series have been subject to *Jarque-Bera Tests.* Results of such tests are being presented through the Table-2 below.

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Table-2

Statistics of residuals of the CAPM Regression Equations *(Time span- 2014-2015)*					
Stock Name	**Mean**	**Median**	**Skewness**	**Jarque-Bera**	**Probability**
Jindal	2.59e-16	0.006401	1.015	2551.255	0.000000
Bharat Petrolium	1.29e-16	-0.213	0.374	15.40840	0.000451
Cipla Ltd.	-1.98e-17	-0.097	0.202	39.70550	0.000000
Coal India Ltd.	3.35e-17	-0.106	0.571	599.1698	0.000000
GAIL	-1.63e-16	-0.049	-0.064	30.94303	0.000000
HDFC Mutual Fund	-8.42e-17	0.0009	0.291	29.82352	0.000000
HDFC	2.03e-17	-0.045	0.218	29.87937	0.000000
Hero Motocorp	-9.89e-17	0.024	0.096	17.44670	0.000163
Hindalco	-1.55e-16	-0.082	0.226	34.85824	0.000000
Kotac Mahendra	-3.39e-16	-0.074	0.77	147.058	0.000000
Larsen	-1.10e-17	-0.037	-0.208	328.7368	0.000000
Lupin	9.89e-18	-0.0922	-0.046	52.83623	0.000000
Maruti Suzuki Ltd	6.05e-18	-0.146	0.488	902.4216	0.000000
Oil & Natural Gas Corporation. Ltd.	-9.18e-17	-0.095	0.698	126.9234	0.000000
ACC	0.000173	-0.110000	0.543371	25.80429	0.000002
ICICI Bank	1.65e-18	-0.060	0.62	95.33591	0.000000
Punjab National Bank	-3.93e-17	-0.074	0.770	147.0458	0.000000
Reliance Industries Ltd	4.95e-8	-0.031	0.259	18.06737	0.000119
State Bank Of India	1.91e-18	-0.108	0.906	195.663	0.000000
Wipro Ltd	-8.46e-17	-0.025	-0.427	103.5006	0.000000
Sun Pharmaceutical Industries Ltd	-8.77e-17	-0.0014	-1.195	2069.907	0.00000
Tata Power Company Ltd	8.89e-17	-0.106	0.243	37.79316	0.000000
Tata Consultancy Services Ltd	-4.38e-17	-0.105	-0.533	463.0322	0.000000
TIC	-8.46e-17	0.045	-1.030	688.3505	0.000000
Asian Paints	-5.63e-17	-0.016	0.399	75.59700	0.000000
Hidustan Unilever	0.065	-0.115	0.794	261.5134	0.000000
Infosys	-5.99e-17	-0.027	0.397	1589.505	0.000000
M&M	-5.51e-17	-0.081	0.318	17.25076	0.000179
Tata Steel	1.91e-17	-0.108	0.906	195.6616	0.000000
Tata Motors	4.95e-17	-0.074	0.027	0.669593	0.715484

It is observed from the Table-2 that

(i) residual series for the 29 companies (barring Tata Motors) under study were significantly (at 5% level) skewed as corresponding *Jarque-Bera Test statistics* suggest. It implies that, for these companies, expected rate of return deviated significantly from the actual rate of return.

(ii) for seven companies residuals are negatively skewed implying actual rate of return lagging behind the expected rate of return for each of these companies. These companies include Gail, Larsen, Kotak Mahendra, Lupin, Wipro, Sun Pharmaceutical Industries Ltd., TIC. Consequently, stocks of these companies are **'***Overvalued***'**.

(iii) residuals of the stocks for Tata Motors are normally distributed as confirmed by *Jarque-Bera Test statistic.* For this company actual rate of return equals the expected rate of return- implying *'Just Valuation'* of the stock.

(iv) residuals of stocks for the remaining 22 companies are positively skewed, given the *Jarque-Bera Test Statistic*. For these companies actual rates of return exceed the corresponding expected rates of return. Thus stocks of these companies are *'Undervalued'*.

V. SUMMERY & CONCLUSION

Section IV

The summery of the findings has been presented through the Table-3.

Table-3. Summary of the Findings

Companies	**Aggressive/Defensive**	**Over/ Under Valued**	**Risk-Return Relation**	**α=0**	**CAPM**
Jindal	Aggressive	Under	Negative	Does not Hold	Does not Hold
Bharat Petrolium	Defensive	Under	Positive	Does not Hold	Holds Partially

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Cipla Ltd.	Defensive	Under	Positive	Holds	Holds
CoalIndia Ltd.	Aggressive	Under	Negative	Holds	HoldsPartially
GAIL	Defensive	Over	Negative	Holds	Holds Partially
HDFC Mutual Fund	Defensive	Under	Positive	Does not Hold	Holds Partially
HDFC	Defensive	Under	Positive	Holds	Holds
Hero Motocorp	Defensive	Under	Negative	Holds	Holds Partially
Hindalco	Aggressive	Under	Negative	Holds	Holds Partially
Kotac Mahendra	Defensive	Over	Positive	Holds	Holds
Larsen	Aggressive	Over	Positive	Holds	Holds
Lupin	Defensive	Over	Positive	Holds	Holds
Maruti Suzuki Ltd	Defensive	Under	Positive	Does not Hold	Holds Partially
Oil & Natural Gas Cor. Ltd.	Aggressive	Under	Negative	Holds	Holds Partially
ACC	Aggressive	Under	Positive	Holds	Holds
ICICI Bank	Aggressive	Under	Positive	Holds	Holds
Punjab National Bank	Defensive	Under	Positive	Holds	Holds
Reliance Industries Ltd	Aggressive	Under	Negative	Holds	Holds Partially
State Bank Of India	Aggressive	Under	Positive	Holds	Holds
Wipro Ltd	Defensive	Over	Negative	Holds	Holds Partially
Sun Ph.In. Ltd	Defensive	Over	Positive	Holds	Holds
Tata Power Company Ltd	Aggressive	Under	Negative	Holds	Holds Partially
TataCon.SerLtd	Defensive	Under	Negative	Holds	Holds Partially s
TIC	Defensive	Over	Negative	Holds	Holds Partially
Asian Paints	Defensive	Under	Positive	Holds	Holds
Hidustan Unilever	Defensive	Under	Positive	Holds	Holds
Infosys	Defensive	Under	Positive	Holds	Holds
M&M	Defensive	Under	Positive	Holds	Holds
Tata Steel	Aggressive	Under		Holds	Holds
Tata Motors	Aggressive	Justified	Positive	Holds	Holds

The summery of the findings has been presented through the Table-3.

The Table-3 helps us identify (i) stocks which were *'under-valued'* or 'over-valued' and *'aggressive'* or *'defensive'*

(ii) stocks for which risk-return relations were positive or negative

(iii) stocks with or without *Homogenous degree one* relation between individual risk premia and market premia

(iv) stocks for which (a) CAPM held good completely or partially or was not applicable at all.

The study shows that (a) *CAPM held good completely for 16 stocks. So CAPM was not found to be applicable to all the stocks under study.*

These findings bear an important practical policy implication for an investor's choice of stocks. If the investor seeks to choose a stock with an expectation that it would attain superior risk-adjusted performance, his choice would be confined to 14 stocks. Again the investor may choose a *'defensive'* stock in order to reduce volatility of his existing portfolio. Moreover, he may opt for an *'under-valued'* stock with the hope reaping returns higher than expected.

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