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CAPITAL ASSET PRICING MODEL (CAPM) AND INDIAN STOCK MARKET WITH AUTOREGRESSIVE INTEGRATED MOVING AVERAGE MODEL

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PURPOSE

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. More specifically, the study is directed to examine (i) the individual risk premia were directly related to market premia, (ii) the risk-return relation for these stocks were positive as dictated by the CAPM, (iii) the stocks were 'underpriced' or 'overpriced' and (iv) the risk adjusted relative performance of these selected stock with respect to the market. (v) the role of CAPM in the choice of stocks by a rational investor.

Design/Methodology/Approach: *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*

$$E(R_{it}) - R_t^* = \beta_i \left[E(R_{mt}) - R_t^*\right] \qquad (1)$$

*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 $_{I}$.

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 $E(R_{it})$.

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Findings: *The study shows that (a) CAPM held good completely for 13 stocks. So CAPM was not found to be applicable to all the stocks under study. (b) 19 stocks display white noise. For 12 of these stocks CAPM held completely (i.e., ~=0, β≠0) and for 5 of these stocks CAPM held partially (i.e., a≠0, β≠0). (c) 11 stocks display ARIMA (p,o,q) structures of stochastic process. For 10 of these stocks CAPM holds partially (i.e., a≠0, β≠0). However, one of these stocks is found to be supportive of CAPM. (d) 10 stocks with white noise or ARIMA (p,o,q) structures, displaying support for CAPM completely (i.e., α=0, β≠0) or partially (i.e., α≠0, β≠0) and which excelled both by the Trenor and Sharpe measures, were, 'undervalued' by nature. These are Bharat Petrolium, Cipla Ltd, HDFC, Kotac Mahendra, Larsen, Lupin, Maruti Suzuki Ltd., Punjab National Bank, Asian Paints, Hindustan Unilever. (e) For 5 of the stocks having white noise structures, which excelled both by the Trenor and Sharpe measures, CAPM held completely. Evidently, all these stocks are 'undervalued' . These are Bharat Petrolium, Kotac Mahendra, Punjab National Bank and Asian Paints and Hindustan Unilever. All these stocks are defensive.*

Research Limitations/Implications: *It considers a time period January, 2014 – August, 2015 for some selected stocks listed in the Bombay Stock Exchange (BSE).*

Practical Implications: *A rational investor may decide to choose a stock with the potentiality of (i) attaining superior risk-adjusted performance in the market (ii) stabilizing the volatility of portfolio which he already possesses and (iii) reaping higher actual rate of returns than expected. In such case, he would choose a 'defensive', 'undervalued' stock. In this case, his choice gets limited to 3 stocks (Cipla, Asian Paints and Hindustan Unilever) with white noise structure for returns.*

Originality/Value: *This study empirically investigates the applicability of CAPM for 30 selected stocks listed in the Bombay Stock Exchange (BSE) over the period January, 2014 – August, 2015. More specifically, the study is directed to examine if individual risk premia were directly related to market premia, if the risk-return relation for these stocks were positive as dictated by the CAPM, if the stocks were 'underpriced' or 'overpriced' and the role of CAPM in the choice of stocks by a rational investor.*

Key Words: *CAPM, Systematic Risk, Skewness, Jarque-Bera Test, Jensen Statistics, Cointegration, Stationarity, Adaptive Expectation, ARIMA (p,d,q) forecasts.*

Introduction

The CAPM was originally developed as an offshoot from the Market Model by Sharpe (1964) and Lintner (1965). The model explains (i) the relationship between the risk and return on a financial security and (ii) uses this relationship to determine the appropriate price of and return on the security. In CAPM capital markets are perfect without the existence of transaction cost. In the presence of any risk-free asset in the capital market, the individual risk-premium, as the CAPM holds, must be linearly and proportionately related to market premium. The constant of proportionately is the systematic risk (β). Following rise in systematic risk, given risk-free rate, expected return on the security concerned rises.

Thus, CAPM holds that (i) individual risk premium is in *Homogenous Degree One* relation with the market premium, and (ii) security return varies directly with the associated risk. This positive *ex post* risk-return relationship is symmetric to the *ex ante* risk-return relation with an investor who undertakes more risk for more return.

Numerous empirical studies had been carried out to investigate applicability of CAPM in different countries. These studies present mixed evidences for CAPM. As a matter of fact, there are abundant evidences against CAPM claiming that there are other factors affecting returns in stock market rather than systematic risk. A brief review of some relevant studies is presented below.

Literature Survey

Galagedera (2014) 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-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.

Douglas (1969), Friend, & Blume (1970), Miller, & Scholes (1972), and Blume, & Friend (1973), and Stambaugh (1982) in their tests generally reject the Sharpe-Lintner model. They found a positive, linear relation between beta and expected return, but it was not steep enough compared to the SML. The tests found that the intercept was above the risk free rate and that the observed slope was smaller than the market risk premium. The implication was that low beta portfolios have positive alphas, and that high beta portfolios have negative alphas.

Bark (1991) in his study used the Fama-MacBeth methodology to test the CAPM in the Korean market. The data was collected from the Daewoo-Yonsei database on monthly stock returns between the period January 1980 to December 1987. The period was subdivided into five overlapping periods of 4 years. The study tests the positive risk return trade off of CAPM. For the entire period there was a negative sign in the market premium. The residual risk was also found to be a significant factor. Thus, the results indicate CAPM cannot be a predictive model in the Korean Market.

Francis, & Fabozzi (1979) conducted a study over a period of 73 months between December 1965 and December 1971 on 694 stocks listed in NYSE. The study looked into the stability of the Single Index Market Model (SIMM). The result of the study supports the hypothesis that SIMM is affected by macroeconomic conditions. The intertemporal instability in the betas frequently observed could be due to this business cycle economics.

Dai, Hu, & Lan (2014) 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.

Jensen, & Scholes (1972) 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.

Reddy, & Durga (2015) 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.

Rao, & Mukherjee (1971) tested the Random Walk hypothesis on Indian Aluminium weekly average share price data for a period of 16 years (1955-70) collected from the Calcutta stock exchange. Spectral analysis of the data indicated that Random Walk hypothesis holds for Indian Aluminium.

In the study by Jarlee (2007) tools like CAPM, Time-series test, cross-sectional test were employed for teh period of January 2001 – December 2006. 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, et al., (2001) 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 and June 2001.

Fearnley (2002) 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.

Reddy, & Thomson (2014) examined the capital-asset pricing model (CAPM) for the South African security markets. In this research paper they considered quarterly total returns from 10 sectoral indices listed on the JSE Securities Exchange for the period 30 June 1995 - 30 June 2009. They found, on the assumption of normal distribution of the residuals of the return-generating function, that CAPM could be rejected for certain periods. However, the use of the CAPM for long-term actuarial modeling in the South African market could be reasonably justified.

Shashikant (1988) conducted the study on a sample of 100 companies, selected from actively traded shares in 1964. The study period was 1965-87, and the rate of return was found to be increasing with holding period. Except for war years of 1965 and 1971 other returns were positive, confirming Sub Martingale model of share price.

Vaidyanathan, & Ray (1992) found that for companies belonging to chemical industries, market risk is less than 40%, as per cent of total risk. In the case of other types of industries market risk was less than 50% of total risk.

Vaidyanathan, & Gali (1993) found a settlement period effect in the Bombay Stock Exchange scrips during 1989 and 1990. The average return of the first trading day of the settlement period is usually higher than that on the last trading day and the intermediate days. In fact it was higher than that on the last trading day and immediate days, rather higher than the overall daily average returns.

Nel (2011) emphasized on two of its main components, namely the risk-free rate and beta. He held that both academia and investment practitioners favored the CAPM but they disagreed significantly with regard to the components of the CAPM, and the use of alternative models.

Objective of the Study

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(ii) if the risk-return relation for these stocks were positive as dictated by the CAPM,

(iii) if the stocks were ‘underpriced’ or ‘overpriced’ and

(iv) the risk adjusted relative performance of these selected stock with respect to the market.

(v) the role of CAPM in the choice of stocks by a rational investor.

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 Bill & data on the risk-free rates for the relevant period were obtained from the RBI Bulletin, a publication of 91-day Treasury RBI.

Section I: Methodology

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

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

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${}_i$ = 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 ${}_i$.

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 $E(R_{it})$.

Methodological Issues

Equation (1) contains three variables viz $E(R_{it})$, $E(R_{mt})$ and ${}_i$ while R_t^* is proxied through the arithmetic average of historical risk free rates of return.

$E(R_{it})$ and $E(R_{mt})$ are unobservable. In most of the studies cited in literature survey $E(R_{mt})$ is usually estimated by measuring the average of the historical returns on a market portfolio. Again, the time series data on R_{it} and R_{mt} can be used to measure σ_i, σ_m and ρ_{im}.

These can be used to estimate

$$\beta_i = \frac{Cov(R_i R_m)}{Var(R_m)} = \frac{\sigma_i \rho_{im}}{\sigma_m} \qquad (2)$$

Thus, $E(R_{mt})$, R_t* and $_1$ are obtained and these statistics can be used to measure $E(R_{it}) - R_t*$ by the equation (1), $E(R_{it}) - R_t * = {}_i [E(R_{mt}) - R_t *]$

This estimation involves the measure of $E(R_{mt})$ and R_t*, the average rate of return on R_{mt} and the 'average rate of return on risk-free assets' derived on the basis of the historical datasets for the variables concerned. Thus $E(R_{mt})$, R_t* and $_i$ are *'single fixed values'* used for the estimation of a *single fixed value* for $E(R_{it})$. As a result, the study looses the dynamic charm and intricacy of the relations between $E(R_{mt})$ and $E(R_{it})$ over the period of study concerned.

Alternative Methodology

Let R_{it} and R_{mt} be the series of returns for any stock and market. Then $E(R_{it})$ and $E(R_{mt})$ represent the forecast values of R_{it} and R_{mt} based on the respective univariate stochastic structures for the variables concerned such that $E(R_{it})$ =(t-1)$E(R_{it})$ and $E(R_{mt})$ = (t-1) $E(R_{mt})$. Thus, the series for $E(R_{it})$ and $E(R_{mt})$ represent the ***'one-period ahead'*** forecast series for $E(R_{it})$ and $E(R_{mt})$.

The past and present realization of any sequence, are used for consisting univariate ARIMA (p,d,q) which is assumed to be the stochastic process generating the sequence. If the economic structure remains unchanged for the next period/periods, then the stochastic process will also remain unchanged. Consequently, the identified univariate structure for the $\{Y_t\}$ sequence will also remain unchanged. In that case, the realization of $\{Y_t\}$ at period (t+1) can be determined, and this realization is considered to be a forecast for Y_t at period (t+1).

Let the ARIMA(p,d,q) model be

$$\varphi(\beta)\, \Delta^d y_t = \varphi(\beta)\, \omega_t = \theta(\beta)\varepsilon_t \quad \text{......(3)}$$

with $\varphi(\beta) = 1- \varphi_1 \beta - \varphi_2 \beta^2 - \text{..........} - \varphi_p \beta^p$

and $\theta(\beta) = 1- \theta_1 \beta - \theta_2 \beta^2 \text{..........} - \theta_q \beta^q$

Eqn (3) can be expressed in terms of error term series ε_t such that

$$\varepsilon_t = \theta^{-1} (\beta)\, \varphi(\beta)\, \omega_t \quad \text{......(4)}$$

where $\omega_t = \Delta^d y_t$

The objective in estimation is to find a set of auto- regressive parameters ($\varphi_1, \varphi_2, \dots \varphi_p$), and a set of moving average parameters ($\theta_1, \dots \theta_q$) which minimize the sum of squared errors

$$S(\varphi_1, \dots, \varphi_p, \theta_1, \dots, \theta_q) = \sum_t {}_1\varepsilon^2_t \quad \text{......(5)}$$

Now let us assume that the error terms $\varepsilon_1, \dots \varepsilon_T$ are all normally distributed and independent with mean 0 and variance σ^2_e. Then the conditional log-likelihood function associated with parameter values ($\varphi_1, \dots, \varphi_p, \theta_1, \dots, \theta_q, \sigma_e$) is given by θ_ε

$$L = -T \log \sigma_\varepsilon - S(\varphi_1, \dots, \varphi_p, \theta_1, \dots, \theta_q) / 2\sigma^2_\varepsilon \quad \text{......(6)}$$

Here L is the **conditional logarithmic likelihood function.** Consequently,

$$\varepsilon_1 = \omega_1 - \varphi_1\, \omega_0 - \varphi_2 \omega_{-1} - \dots - \varphi_p\, \omega_{-p+1} + \theta_1 \varepsilon_0 + \dots + \theta_q\, \varepsilon_{-q+1} \quad \text{......(7)}$$

Equation (6) shows that the maximum-likelihood estimate of the model's parameters is given by the minimization of the sum of squared residuals. Thus, under the assumption of normally distributed errors, the maximum-likelihood estimate is the same as least-square- estimate.

Minimum Mean-Square- Error Forecasts

Optimum forecasts are 'forecasts with **minimum mean-square forecast error'**. Thus, the forecast $\hat{y}_T(l)$ will be so chosen that $E[e^2(l)] = E\{[y_{T+e} - \hat{y}_T(l)]^2\}$ is minimized. This forecast is the conditional expectation of y_{T+l} such that

$$\hat{y}_{T+l} = E\,[y_{T+l} / y_{T,} y_{T-1,} \ldots , y_1] \quad \ldots\ldots (8)$$

Equation (8) gives the minimum mean-square-error forecast.

Equation (2.17) can be written as

$$\varphi(\beta)\,(1-\beta)^d y_t = \theta(\beta)\varepsilon_t \quad \ldots\ldots (9)$$

since $\Delta = 1-\beta$. Therefore,

$$y_t = \varphi^{-1}(\beta)\,(1-\beta)^{-d}\theta(\beta)\varepsilon_t = \Psi(\beta)\,\varepsilon_t = \sum_{j=0} \Psi_j\varepsilon_{t-j} \quad \ldots\ldots (10)$$

Equation (10) expresses the ARIMA model as a purely moving average process of infinite order. Then

$$y_{T+l} = \Psi_0\varepsilon_{T+l} + \Psi_1\varepsilon_{T+l-1} + \ldots\ldots + \Psi_l\varepsilon_T + \Psi_{l+1}\varepsilon_{T-1} + \ldots$$

$$= \Psi_0\varepsilon_{T+l} + \Psi_1\varepsilon_{t+l-1} + \ldots\ldots + \Psi_{l-1}\varepsilon_{T+1} + \sum_{j=0} \Psi_{l+j}\varepsilon_{T-j} \quad \ldots\ldots (11)$$

In equation (11) the infinite sum has been divided into two parts. The second part begins with the term $\Psi_j\varepsilon_T$ and thus, describing information up to and including time period T.

However, the forecast $\hat{y}_{T(l)}$ can be based only on information available up to time T. Now forecast can be written as a weighted sum of those error terms, $\varepsilon_{T,}\ \varepsilon_{T-1,\ldots}$. Then the desired forecast is

$$\hat{y}_T(l) = \sum_{j=0} \Psi^*_{l+j}\varepsilon_{T-j} \quad \ldots\ldots (12)$$

where the weights are chosen optimally to minimize the mean square forecast error. Then using equation (11) and (12) we get

$$e_T(l) = y_{T+l} - \hat{y}_T(l)$$

$$= \Psi_0\varepsilon_{t+l} + \Psi_1\varepsilon_{t+l-1} + \ldots\ldots + \Psi_{l-1}\varepsilon_{T+1} + \sum_{j=0} (\Psi_{l+j} - \Psi^*_{l+j})\,\varepsilon_{T-j} \quad \ldots\ldots (13)$$

Since by assumption $E(\varepsilon_{i,}\ \varepsilon_j) = 0$ for $i \neq j$, the mean-square forecast is

$$E\,[e^2_T(l)] = (\Psi^2_0 + \Psi^2_1 + \ldots + \Psi^2_{l-1})\sigma^2_\varepsilon + \sum_{j=0} (\Psi_{l+j} - \Psi^*_{l+j})^2\sigma^2_\varepsilon \quad \ldots\ldots (14)$$

Then this expression is minimized by setting the "optimum" weights Ψ^*_{l+j} equal to true weights $\Psi_{l+j,}$ for j= 0,1, … In that case optimal forecast $\hat{y}_T(l)$ just becomes the conditional expectation of y_{T+l}. Consequently,

$$\hat{y}_T(l) = \Sigma\Psi_{l+j}\varepsilon_{T-j} = E[y_{T+l}/y_{t,\ldots}\, y_1] \quad \ldots\ldots (15)$$

Equation (13) provides the basic principal for estimations of forecast from ARIMA models.

In this study we are initially concerned with time series datasets on $R_{it,}$ R_{mt}, and R^*_t . R_{it} for some stocks are white noise while for other stocks $R_{it} \sim I(0)$ entail some ARIMA (p,0,q) structures. ARIMA (p,0,q) for these stocks have been identified and estimated. Again Minimum Mean-Square

Error (MMSE) one period ahead forecasts have been generated for these concerned variables on the basis of the respective estimated ARIMA (p,0,q) structures.

Let $E(R_{it})$ and $E(R_{mt})$ represent one period ahead forecast series for any return and market return respectively. Then

$R_{it} = E(R_{it}) + £_{it}$

and $R_{mt} = E\ (R_{mt}) + £_{mt}$

where $£_{it}$ and $£_{mt}$ are the forecast error series concerned such that

$£_{it} = R_{it} – E\ (R_{it})$

$£_{it} = R_{mt} – E\ (R_{mt})$

Where $£_{it}$ and $£_{mt}$ are white noise.

Since

$R_{it} \sim I\ (0)\ and\ R_{mt} \sim I\ (0),\ E\ (R_{it}) \sim I\ (0)\ and\ E\ ((R_{mt}) \sim I\ (0),$

given that $£_{it}$ and $£_{mt}$ are white noise.

Now $[E\ (R_{it}) – R^*]\ and\ [(ER_{mt}) – R^*]$ constitute two different datasets. Let

$E\ (R_{it}) – R^* = Y_{it}$

and

$E\ (R_{mt}) – R^* = X_{it}$

Then CAPM equation can be written as

$Y_{it} = \sim + \quad X_{it} + u_t$ .... (16)

where $u_t \sim iidN\ (0, \pm_u^2)$

CAPM is valid if $\alpha = 0$ and $\beta \neq 0$

The estimated *co-integrating equation* obtained through regression on equation (16) is

$\hat{Y}_{it} = \hat{\alpha} + \hat{\beta} X_{it}$ .... (17)

Regression theoretically involves finding the 'Conditional Expectation' of the regress and such that

$\hat{Y}_{it} = E(Y_{it}/X_{it})$

In this case regression on equation (16) shows

$E(Y_{it}/X_{it}) = \hat{\alpha} + \hat{\beta}\ E(X_{it}/X_{it}) + E(u_{it}/X_{it})$

ARIMA (p,d,q) one-step-ahead forecasts for returns basically represent '*Adaptive Expectations'* for the returns concerned. However, some return series exhibit 'white noise' stochastic structure-such that

$Y_{it} = e_{it}$

where y_{it} = return series for the stock ***i*** . In this case the conditional expectation of y_{it} is zero, such that

$E\ (Y_{it}/Y_{it-1},\ Y_{it-2}$ KKK=KKKF== $E\ (e_{it}) = 0$

It may be noted that Fama (1991) holds that, in the event of market being *'efficient'*, stock series (p_t) display *'random walk'* process and the return series display *'white noise'* process such that no forecast for return becomes possible on the basis of past and present sets of information.

Again 'efficient market' for any stock implies that agents and investors for these stocks are '*rational'* and, therefore, *'rational expectations hypothesis'* becomes relevant for these stock such that (t-1) $E(y_t) = y_t$.

Section II : Estimation and Findings

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

Table No. 1: Results of ADF Unit Root Tests on the Return Series $[R_{it} – R_t^*]$ and $[R_{mt} – R_t^*]$ at level (1.1.2014 – 21.8.2015)

Securities	ADF Statistics of the Return Series $[R_{it} – R_t^*]$ and $[R_{mt} – R_t^*]$ with exogenous constant	Critical Values At 1% level	Inference on Stationarity & Integrability
Market(BSE)	-15.03369	-3.446402	I(0)
Jindal	-20.47825	-3.446362	I(0)
Bharat Petrolium	-19.01948	-3.446362	I(0)
Cipla Ltd.	-19.19244	-3.446362	I(0)
Coal India Ltd.	-18.99994	-3.446362	I(0)
GAIL	-19.50178	-3.446362	I(0)
HDFC Mutual Fund	-23.40784	-3.446362	I(0)
HDFC	-16.31812	-3.446402	I(0)
Hero Motocorp	-18.72367	-3.446362	I(0)
Hindalco	-19.14793	-3.446362	I(0)
Kotac Mahendra	-19.64522	-3.446362	I(0)
Larsen	-17.97588	-3.446362	I(0)
Lupin	-18.40737	-3.446362	I(0)
Maruti Suzuki Ltd	-15.31997	-3.446402	I(0)
Oil & N. Gas Cor. Ltd.	-20.23135	-3.446362	I(0)
ACC	-19.68971	-3.446362	I(0)
ICICI Bank	-17.61668	-3.446362	I(0)
Punjab National Bank	-19.64522	-3.446362	I(0)
Reliance Industries Ltd	-18.39252	-3.446362	I(0)
State Bank Of India	-15.09675	-3.446402	I(0)
Wipro Ltd	-20.24080	-3.446362	I(0)
Sun Phar. Industries Ltd	-19.13999	-3.446362	I(0)
Tata Power Company Ltd	-20.84480	-3.446362	I(0)
Tata Consult. Services Ltd	-20.16163	-3.446362	I(0)
TIC	-19.36504	-3.446362	I(0)
Asian Paints	-20.41211	-3.446362	I(0)
Hidustan Unilever	-19.14480	-3.446362	I(0)
Infosys	-19.49928	-3.446362	I(0)
M&M	-19.84226	-3.446362	I(0)
Tata Steel	-15.09675	-3.446402	I(0)
Tata Motors	-19.29676	-3.446362	I(0)

It is observed that premia of all the individual securities and of the market are I(0) indicating that the premia are stationary at level.

From the Table No. 1 it is observed that

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

$$Y_t = \sim + \quad X_t + u_t \qquad (18)$$

where $u_t \sim \text{iidN}\,(0, \sigma^2_u)$

It is observed that returns of 19 stocks exhibit *White Noise Process*. These stocks are Jindal, Bharat Petrolium, Cipla Ltd, Coal India Ltd., GAIL, Hero Motocorp, Hindalco, Kotac Mahendra, ACC, Punjab National Bank, Sun Phar. Industries Ltd., Tata Power, Wipro, Tata Consultency, TIC, Asian Paints, Hindustan Unilever, Infosys.

Again returns of 11 stocks display ARIMA(p,0,q) structures. These stocks are HDFC Mutual Fund [ARIMA(1,0,6)], HDFC[ARIMA(2,0,0)], Larsen[ARIMA(1,0,2)], Lupin [ARIMA(1,0,0)], Maruti Suzuki Ltd. [ARIMA(2,0,5)],ONGC [ARIMA(2,0,0)], ICICI bank [ARIMA(1,0,0)], Reliance Industries Ltd. [ARIMA(1,0,0)], State Bank of India [ARIMA(2,0,0)] and M&M [ARIMA(2,0,0)]. The ARIMA forecasts of these stock returns have been estimated.

Results of estimation of the equation (18) for securities of 30 different companies are being presented below in Table No. 2.

Findings

It has been observed from Tables No. 2 and 3 that

(i) (a) R^2 value in each of the estimated equations is low. Yet F values, which are significant at 1% or 5% level, indicate that the estimated equations are good fit. Thus, linear relationship between individual risk premium and market risk premium gets confirmed.

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

(ii) (a) Average returns for 17 companies exceed that for the market. These companies are Bharat Petrolium, Maruti Suzuki Ltd, Lupin, Kotac Mahendra, Punjab National Bank, Asian Paints, Cipla Ltd., Sun Pharm. Indus. Ltd, Larsen, HDFC, State Bank Of India, Tata Steel, Hidustan Unilever, M&M, ICICI Bank, Infosys and ACC.

Again standard deviations of returns of these companies, which measure total risk involved, exceed that for the market. Higher standard deviation with higher return implies positive risk-return relationship in case of these companies.

(b) Average returns for the remaining 13 companies lag behind for that market. However, standard deviation of returns for 12 of these companies exceed that of the market. For HDFC Mutual Fund both the average return and standard deviation fall short of those of the markets. For these 12 companies there exist an asymmetric risk-return relationship.

(c) 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.

(iii) $\hat{\alpha}$ is not statistically significant (even for 5% level) for securities of 18 companies. However, $\hat{\alpha}$

Table No. 2: Estimated Cointegration Equations for the Selected Stocks

Stock Name	1/2014 to 8/2015	Estimate	Std. Error	t value	Pr(>|t|)
Jindal	Slope(β)	2.330243	0.860354	2.708470	0.0071
	Intercept Term	-0.439299	0.178532	-2.460615	0.0143
	R^2 =0.018, Adj. R^2 = 0.015, F-Stat=7.33. & Pro(0.007), D-W stat=2.10, AIC=5.25,SC=5.27				
Bharat Petrolium	*Slope( )*	1.772924	0.540672	3.279109	0.0011
	Intercept Term	0.151345	0.112195	1.348946	0.1781
	R^2 =0.026, Adj. R^2 = 0.023, F-Stat=10.75. & Pro(0.001), D-W stat=1.98, AIC=4.32,SC=4.33				
Cipla Ltd.	*Slope( )*	1.242116	0.433614	2.864564	0.0044
	Intercept Term	0.060323	0.089979	0.670413	0.5030
	R^2 =0.020, Adj. R^2 = 0.017, F-Stat=8.20. & Pro(0.004), D-W stat=1.97, AIC=3.88,SC=3.90				
Coal India Ltd.	*Slope( )*	1.242116	0.433614	2.864564	0.0044
	Intercept Term	0.060323	0.089979	0.670413	0.5030
	R^2 =0.020, Adj. R^2 = 0.017, F-Stat=8.20. & Pro(0.004), D-W stat=1.97, AIC=3.88,SC=3.90				
GAIL	*Slope( )*	1.418465	0.465680	3.046007	0.0025
	Intercept Term	-0.113830	0.096633	-1.177958	0.2395
	R^2 =0.022, Adj. R^2 = 0.020, F-Stat=9.27. & Pro(0.0024), D-W stat=2.021, AIC=4.025,SC=4.045				
HDFC Mutual Fund	*Slope( )*	0.078266	0.053896	1.452173	0.1472
	Intercept Term	-0.036020	0.011208	-3.213836	0.0014
	R^2 =0.005, Adj. R^2 = 0.002, F-Stat=2.10. & Pro(0.14), D-W stat=1.35, AIC=-0.28,SC=-0.26				
HDFC	*Slope( )*	0.353733	0.040839	8.661686	0.0000
	Intercept Term	0.097866	0.008474	11.54828	0.0000
	R^2 =0.158, Adj. R^2 = 0.156, F-Stat=75. & Pro(0.00), D-W stat=1.61, AIC=-0.84,SC=-0.82				
Hero Motocorp	*Slope( )*	0.980933	0.407875	2.404985	0.0166
	Intercept Term	-0.005550	0.084638	-0.065579	0.9477
	R^2 =0.014, Adj. R^2 = 0.011, F-Stat=5.78. & Pro(0.016), D-W stat=1.92, AIC=3.76,SC=3.78				
Hindalco	*Slope ( )*	1.168161	0.641626	1.820626	0.0694
	Intercept Term	-0.128130	0.133144	-0.962344	0.3365
	R^2 =0.008, Adj. R^2 = 0.005, F-Stat=3.31. & Pro(0.069), D-W stat=1.97, AIC=4.66,SC=4.68				
Kotac Mahendra	*Slope( )*	1.444189	0.431651	3.345735	0.0009
	Intercept Term	0.073845	0.089572	0.824418	0.4102
	R^2 =0.024, Adj. R^2 = 0.027, F-Stat=11. & Pro(0.000), D-W stat=2.04, AIC=3.87,SC=3.89				

Contd...

Stock Name	**1/2014 to 8/2015**	**Estimate**	**Std. Error**	**t value**	**Pr(>|t|)**
Larsen	*Slope( )*	0.676276	0.050106	13.49682	0.0000
	Intercept Term	0.099767	0.010398	9.595177	0.0000
	R^2 =0.31, Adj. R^2 = 0.31, F-Stat=182 & Pro(0.000), D-W stat=2.84, AIC=-0.43,SC=-0.41				
Lupin	*Slope( )*	0.0100965	0.034639	2.914789	0.0038
	Intercept Term	0.185685	0.007188	25.83	0.0000
	R^2 =0.0209, Adj. R^2 = -0.0194, F-Stat=8.49 & Pro(0.0030), D-W stat=1.76, AIC=-1.17,SC=-1.15				
Maruti Suzuki Ltd	*Slope( )*	0.350444	0.073685	4.755978	0.0000
	Intercept Term	0.222086	0.015323	14.49383	0.0000
	R^2 =0.054, Adj. R^2 = -0.051, F-Stat=22 & Pro(0.00), D-W stat=1.83, AIC=0.33,SC=0.35				
Oil & Natural Gas Corporation Ltd	*Slope( )*	0.347660	0.058628	5.929963	0.0000
	Intercept Term	-0.025101	0.012166	-2.063255	0.0397
	R^2 =0.081, Adj. R^2 = 0.079, F-Stat=35 & Pro(0.00), D-W stat=1.80, AIC=-0.11,SC=-0.09				
ACC	*Slope( )*	1.207197	0.419446	2.878073	0.0042
	Intercept Term	-0.010991	0.087039	-0.126271	0.8996
	R^2 =0.020, Adj. R^2 = 0.017, F-Stat=8.28. & Pro(0.004), D-W stat=2.04, AIC=3.81,SC=3.83				
ICICI Bank	*Slope( )*	0.563833	0.052927	10.65298	0.0000
	Intercept Term	0.055540	0.010983	5.056935	0.0000
	R^2 =0.22, Adj. R^2 = 0.22, F-Stat=113. & Pro(0.000), D-W stat=1.68, AIC=-0.32,SC=-0.30				
Punjab National Bank	*Slope( )*	1.444189	0.431651	3.345735	0.0009
	Intercept Term	0.073845	0.089572	0.824418	0.4102
	R^2 =0.027, Adj. R^2 = 0.024, F-Stat=11. & Pro(0.000), D-W stat=2.042, AIC=3.87,SC=3.89				
Reliance Industries Ltd	*Slope( )*	0.523460	0.039912	13.11542	0.0000
	Intercept Term	-0.011725	0.008282	-1.415720	0.1576
	R^2 =0.30, Adj. R^2 = 0.30, F-Stat=172. & Pro(0.000), D-W stat=2.88, AIC=-0.88,SC=-0.86				
State Bank Of India	*Slope( )*	0.966850	0.074985	12.89393	0.0000
	Intercept Term	0.058226	0.015560	3.741986	0.0002
	R^2 =0.29, Adj. R^2 = 0.29, F-Stat=166. & Pro(0.000), D-W stat=2.60, AIC=.37,SC=.39				
Wipro Ltd	*Slope( )*	0.161067	0.394352	0.408436	0.6832
	Intercept Term	0.013025	0.081832	0.159164	0.8736
	R^2 =0.0004, Adj. R^2 =- 0.0020, F-Stat=0.16. & Pro(0.68), D-W stat=2.03, AIC=3.69, SC=3.71				
Sun Pharmaceutical Industries Ltd	*Slope( )*	0.761180	0.509156	1.494984	0.1357
	Intercept Term	0.075262	0.105655	0.712340	0.4767

Contd...

Stock Name	1/2014 to 8/2015	Estimate	Std. Error	t value	Pr(>|t|)
	R^2 =0.005, Adj. R^2 = 0.003, F-Stat=2.23. & Pro(0.13), D-W stat=1.93, AIC=4.20,SC=4.22				
Tata Power Company Ltd	*Slope( )*	0.712101	0.531002	1.341051	0.1807
	Intercept Term	-0.065551	0.110188	-0.594904	0.5522
	R^2 =0.004, Adj. R^2 = 0.002, F-Stat=1.79. & Pro(0.18), D-W stat=2.16, AIC=4.28,SC=4.30				
Tata Consultancy Services Ltd	*Slope( )*	0.802277	0.385629	2.080436	0.0381
	Intercept Term	-0.002353	0.080022	-0.029407	0.9766
	R^2 =0.010, Adj. R^2 = 0.008, F-Stat=4.32. & Pro(0.038), D-W stat=2.040, AIC=3.64,SC=3.68				
TIC	*Slope( )*	0.421375	0.389791	1.081027	0.2803
	Intercept Term	-0.009414	0.080886	-0.116381	0.9074
	R^2 =0.0029, Adj. R^2 = 0.0004, F-Stat=1.16. & Pro(0.28), D-W stat=1.95, AIC=3.66,SC=3.68				
Asian Paints	*Slope( )*	1.183549	0.439925	2.690343	0.0074
	Intercept Term	0.076288	0.091289	0.835679	0.4038
	R^2 =0.017, Adj. R^2 = 0.015, F-Stat=7.23. & Pro(0.007), D-W stat=2.087, AIC=3.91,SC=3.93				
Hidustan Unilever	*Slope( )*	0.818204	0.384219	2.129527	0.0338
	Intercept Term	0.065209	0.079729	0.817883	0.4139
	R^2 =0.011, Adju. R-squared = 0.008, F-Stat=4.53. & Pro(0.033),D-W=1.93, AIC=3.64, SC=3.66				
Infosys	*Slope( )*	0.268304	0.429805	0.624247	0.5328
	Intercept Term	0.067791	0.089189	0.760079	0.4477
	R^2 =0.0009, Adju. R-squared = -0.001, F-Stat=0.38. & Pro(0.53),D-W=1.95, AIC=3.86, SC=3.84				
M&M	*Slope( )*	0.758686	0.444302	1.707590	0.0885
	Intercept Term	-0.055471	0.092197	-0.601661	0.5477
	R^2 =0.007, Adju. R-squared = -0.004, F-Stat=2.91. & Pro(0.08),D-W=2.03, AIC=3.93, SC=3.95				
Tata Steel	*Slope( )*	0.966850	0.074985	12.89393	0.0000
	Intercept Term	0.058226	0.015560	3.741986	0.0002
	R^2 =0.29, Adju. R-squared = 0.29, F-Stat=166. & Pro(0.000), D-W=2.60, AIC=0.37, SC=0.39				
Tata Motors	*Slope( )*	1.199265	0.498681	2.404873	0.0166
	Intercept Term	-0.093208	0.103481	-0.900720	0.3683
	R^2 =0.014, Adju. R-squared = -0.011, F-Stat=5.78. & Pro(0.016),D-W=2.01, AIC=4.16, SC=4.18				

* represents significance at 5% level

Table No. 3

Securities of Com.	Average Rate of Return over the Period	S. D. of Return		R^2
Market (BSE)	0.067675	0.868551	1	1
Risk free bond	0.084530	0.005938	1	1
Jindal	-0.268911	3.344780	2.330243	0.018
Bharat Petrolium	0.253986	2.127500	1.772924	0.026
Cipla Ltd.	0.151083	1.698382	1.242116	0.020
Coal India Ltd.	0.063872	2.000806	1.242116	0.020
GAIL	-0.007255	1.819446	1.418465	0.022
HDFC Mutual Fund	-0.026212	0.792115	0.078266	0.005
HDFC	0.123062	1.222526	0.353733	0.158
Hero Motocorp	0.063168	1.583670	0.783786	0.014
Hindalco	-0.055650	2.484021	1.168161	0.008
Kotac Mahendra	0.174085	1.690386	1.444189	0.024
Larsen	0.135437	1.719397	0.676276	0.31
Lupin	0.190245	1.607050	0.347685	0.001
Maruti Suzuki Ltd	0.248220	1.573817	0.350444	0.054
Oil & N. Gas Co. Ltd.	-0.009409	2.003806	0.347660	0.081
ACC	0.06910	1.636005	1.207197	0.020
ICICI Bank	0.090244	1.801447	0.563833	0.22
Punjab National Bank	0.174085	1.690386	1.444189	0.027
Reliance Indus. Ltd	0.016958	1.542016	0.523460	0.30
State Bank Of India	0.121447	1.939410	0.966850	0.29
Wipro Ltd	0.021868	1.521060	0.161067	0.0004
Sun Pharm. Indus. Ltd	0.142051	1.968502	0.761180	0.005
Tata Power Comp. Ltd	-0.039521	2.074588	0.712101	0.004
Tata Consul. S. Ltd	0.064989	1.501890	0.802277	0.010
TIC	0.017340	1.506566	0.421375	0.0029
Asian Paints	0.156564	1.715911	1.183549	0.017
Hindustan Unilever	0.118279	1.490878	0.818204	0.011
Infosys	0.084004	1.664721	0.268304	0.0009
M&M	0.097458	1.738543	0.758686	0.007
Tata Steel	0.121447	1.939410	0.966850	0.29
Tata Motors	-0.039521	2.074588	1.199265	0.014

is statistically significant (at 5% level) for securities of 12 companies like Jindal, Cipla, HDFC Mutual Fund, HDFC, Larsen, Lupin, Maruti Suzuki Ltd.,ONGC, ICICI bank, SBI, M&M and Tata Steel. Therefore, $\alpha = 0$ assumption behind CAPM does not strictly hold for securities of these 12 stocks. However, this assumption ($\alpha = 0$) behind CAPM holds for the rest 18 companies.

(iv) $\hat{\beta}$ is significant (i.e.,$\beta \neq 0$) at 1% or 5% level for the returns of 25 companies concerned. Therefore, *cointegration* between security returns and market returns are established for the companies implying that variation in security risk premium is linearly related to market risk premium, given that corresponding residuals are I(0).

(v) In case of 13 companies for which $\hat{\alpha}$ is 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 12 companies, as cited above, for which is $\hat{\alpha}$ 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 12 companies CAPM does not hold strictly.

(vi) For 5 stocks $\hat{\beta}$ is found to be statistically (even at 5% level) insignificant. These companies are Infosys, Tata Consul. S. Ltd, Tata Power Company Ltd., Sun Pharm. Indus. Ltd, and Wipro Ltd. Therefore, CAPM does not hold for these stocks at all.

(vi) (a) $|\hat{\beta}| > 1$ for security returns of 9 companies. These companies are Jindal, Bharat Petrolium,Coal India Ltd, Gail, Hindalco, Kotac Mahendra, Punjub National Bank, Reliance Industries ltd, 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 21 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'*. It may be stated that in case of 5 of these companies for which $\hat{\beta}$ is found to be statistically insignificant (even at 5% level) as stated in (vi) above CAPM does not hold at all.

Section III: Summary & Conclusion

The summary of the findings has been presented through the Table No. 4.

Table No. 4

Summary of the Findings

Stocks	**Stochastic Structure of Return**	**Over/ Under**	**Risk-Return relation**	**~ = 0**	**≠0**	**CAPM**	**Aggressive/ Defemsive**
Jindal	WN	Over	Negative	Does not hold	Holds	Holds Partially	Aggressive
Bharat Petrolium	WN	Under	Positive	Holds	Holds	Holds	Aggressive
Cipla Ltd.	WN	Under	Positive	Does not hold	Holds	Holds Partially	Defensive
CoalIndia Ltd.	WN	Under	Negative	Holds	Holds	Holds	Aggressive
GAIL	WN	Over	Negative	Holds	Holds	Holds	Aggressive
HDFC Mutual Fund	ARIMA(1,0,6)	Under	Negative	Does not hold	Holds	Holds Partially	Defensive
HDFC	ARIMA(2,0,0)	Under	Positive	Does not hold	Holds	Holds Partially	Defensive
Hero Motocorp	WN	Under	Negative	Holds	Holds	Holds	Defensive
Hindalco	WN	Over	Negative	Holds	Holds	Holds	Aggressive
Kotac Mahendra	WN	Under	Positive	Holds	Holds	Holds	Aggressive
Larsen	ARIMA(1,0,2)	Under	Positive	Does not hold	Holds	Holds Partially	Defensive
Lupin	ARIMA(1,0,0)	Over	Positive				Defensive
Maruti Suzuki Ltd	ARIMA(2,0,5)	Over	Positive	Does not hold	Holds	Holds Partially	Defensive
Oil & Natural Gas Cor. Ltd.	ARIMA(2,0,0)	Over	Negative	Does not hold	Holds	Holds Partially	Defensive

Stocks	**Stochastic Structure of Return**	**Over/ Under**	**Risk-Return relation**	**~ = 0**	**≠0**	**CAPM**	**Aggressive/ Defemsive**
ACC	WN	Under	Positive	Holds	Holds	Holds	Defensive
ICICI Bank	ARIMA(1,0,0)	Over	Positive	Does not hold	Holds	Holds Partially	Defensive
Punjab National Bank	WN	Under	Positive	Holds	Holds	Holds	Aggressive
Reliance Industries	ARIMA(1,0,0)	Under	Negative	Holds	Holds	Holds	Aggressive
State Bank Of India	ARIMA(2,0,0)	Over	Positive	Does not hold	Holds	Holds Partially	Defensive
Wipro Ltd	WN	Under	Negative	Holds	Does not hold	Does not hold	Defensive
Sun Ph.In. Ltd	WN	Under	Positive	Holds	Does	Does not	Defensive
					not hold	hold	
Tata Power	WN	Over	Negative	Holds	Does	Does not	Defensive
Company Ltd					not hold	hold	
TataCon.SerLtd	WN	Over	Negative	Holds	Holds	Holds	Defensive
TIC	WN	Under	Negative	Holds	Does not hold	Does not hold	Defensive
Asian Paints	WN	Under	Positive	Holds	Holds	Holds	Defensive
Hidustan Unilever	WN	Under	Positive	Holds	Holds	Holds	Defensive
Infosys	WN	Under	Positive	Holds	Does	Does not	Defensive
					not hold	hold	
M&M	ARIMA(2,0,0)	Over	Positive	Does not hold	Holds	Holds Partially	Defensive
Tata Steel	ARIMA(2,0,0)	Over	Positive	Does not hold	Holds	Holds Partially	Defensive
Tata Motors	WN	Over	Positive	Holds	Holds	Holds	Aggressive

The Table No. 4 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 such that α=0 and β=0

(iv) stocks for which CAPM held good completely (i.e., α=0, $\beta\neq$0). or partially (i.e., $\alpha\neq$0, $\beta\neq$0).or was not applicable at all ($\beta\neq$0).

(v) stocks which had superior risk-adjusted relative performances with respect to market as measured by both Treynor and Sharpe Statistics.

The study shows that

(a) *CAPM held good completely for 13 stocks. So CAPM was not found to be applicable to all the stocks under study.*

(b) 19 stocks display white noise. For 12 of these stocks CAPM held completely (i.e., α=0, $\beta\neq$0) and for 5 of these stocks CAPM held partially (i.e., $\alpha\neq$0, $\beta\neq$0).

(c) 11 stocks display ARIMA(p,o,q) structures of stochastic process. For 10 of these stocks CAPM holds partially (i.e., $\alpha \neq 0$, $\beta \neq 0$). However, one of these stocks is found to be supportive of CAPM.

(d) 10 stocks with white noise or ARIMA (p,o,q) structures, displaying support for CAPM completely (i.e., $\alpha = 0$, $\beta \neq 0$) or partially (i.e., $\alpha \neq 0$, $\beta \neq 0$) and which excelled both by the Trenor and Sharpe measures, were, '*undervalued'* by nature. These are Bharat Petrolium, Cipla Ltd, HDFC, Kotac Mahendra, Larsen, Lupin, Maruti Suzuki Ltd., Punjab National Bank, Asian Paints, Hindustan Unilever.

(e) For 5 of the stocks having white noise structures, which excelled both by the Trenor and Sharpe measures, CAPM held completely. Evidently, all these stocks are *'undervalued'*. These are Bharat Petrolium, Kotac Mahendra, Punjab National Bank and Asian Paints and Hindustan Unilever. All these stocks are defensive.

A rational investor may decide to choose a stock with the potentiality of

(i) attaining superior risk-adjusted performance in the market

(ii) stabilizing the volatility of portfolio which he already possesses and

(iii) reaping higher actual rate of returns than expected

In such case, he would choose a '*defensive', 'undervalued'* stock. In this case, his choice gets limited to 3 stocks (Cipla, Asian Paints and Hindustan Unilever) with white noise structure for returns.

Limitation of the Study

Like most research, a study can hardly be perfect, this study also has few limitations. However, these limitations also present opportunities for future research. Though, this study has presented important and useful contributions to investigate empirically the applicability of CAPM for some selected stocks listed in the Bombay Stock Exchange (BSE) over the period January, 2014 – August, 2015, this study has taken a few number of stocks listed in BSE. Stocks listed in NSE should be taken care of and comparative study must be taken between years.

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