Capital Asset Pricing Model (CAPM) establishes the relationship between risks and returns in the efficient capital markets. A review of studies conducted for various markets in the world reveals that researchers have used a number of methodologies to test the validity of CAPM. While some studies have supported the validity of CAPM, some others have revealed that beta alone is not a suitable determinant of asset pricing and that a number of other factors could explain the cross-section of returns. This paper has attempted to test the validity of the combination effect of the two parameter CAPM to determine the security/portfolio returns. The results show that:

- Intercept is not significantly different from zero.
- The combination of size, and ln(BE/ME)i explains the variation in security returns under both percentage and log returns series.
- The combination of βi and ln(BE/ME)i, βi, (Rm-Rf)i, sizei, and (E/P)i, and (E/P)i and (BE/ME)i explains the variation in security returns when log return series is used and the combination of βi and (Rm-Rf)i explains the variation in security returns when percentage return series is used.
- In case of portfolios, the combination of βp and Rm-Rf explains the variation of portfolio returns when portfolios formed with market value weights under both percentage and log returns and βp and ln(BE/ME)p explain the portfolio percentage returns when market value weights are used.

It is observed that while combinations of some of the independent variables, as opposed to the univariate variable considered in Manjunatha and Mallikarjunappa’s (2006) paper, explain the variations in security/portfolio returns, the other combinations do not explain the variation in the security/portfolio returns. Further analysis in this paper has shown that beta, with some of the combinations of the independent variables, explains the variation in security/portfolio returns. However, beta alone, when considered individually in the two parameter regressions, does not explain the variation in security/portfolio returns. This casts doubt on the validity of the standard form of CAPM.

In the light of these findings, it can be concluded that beta alone is not sufficient to determine the expected returns on the securities/portfolios. The empirical findings of this paper would be useful to financial analysts in the Indian capital market. Further research on the combination of market factors, firms’ specific factors, and macroeconomic factors is needed to enlarge the understanding of modern finance and to cover fresh ground to unravel the mysteries and ramifications of the CAPM puzzle.
Investment in securities market requires the study of the relationship between risks and returns. Sharpe (1964), Lintner (1965), and Mossin (1968) have independently developed a standard form of Capital Asset Pricing Model (CAPM). The studies conducted by Black, Jensen and Scholes (1972), Black (1972, 1993), Fama and MacBeth (1973), and Terregrossa (2001) have largely been supportive of the standard form of CAPM. After 1970s, CAPM came under attack as striking anomalies were reported by Reinganum (1981), Elton and Gruber (1984), Bark (1991), and Harris et al (2003). Further studies on the fundamental factors of securities such as size effect of Banz (1981), book-to-market equity (BE/ME) effect of Chan, Hamao and Lakonishok (1991), earnings-price (E/P) ratio of Ball (1978) and Basu (1983), and studies of CAPM models by Fama and French (1992; 1993; 1996; 1998; 2002; 2004; and 2006), Davis, Fama and French (2000) show that CAPM’s beta (β) is not a good determinant of the expected return of securities/portfolios. But studies by Kothari and Shanken (1995), and Kothari, Shanken, and Sloan (1995) argue in defence of CAPM’s beta (β) and the study by Petkova (2006) argue in defence of Intertemporal CAPM. Guo and Whitelaw (2006) develop and estimate an empirical model based on the intertemporal capital asset pricing model (ICAPM) that separately identifies the two components of expected returns, namely, the risk component and the component due to the desire to hedge changes in investment opportunities. The estimated coefficient of relative risk aversion is positive, statistically significant, and reasonable in magnitude. They show that expected returns are driven primarily by the hedge component arguing that omission of this component is partly responsible for the existing contradiction in results. Théoret and Racicot (2007) use a new set of instruments based on higher statistical moments to discard the specification errors that might be present in the Fama and French (1992, 1993, 1997) model. They show that the usual instruments perform quite poorly in comparison to higher moments. They estimate the Fama and French (1992, 1993, 1997) model on a sample and show that specification errors exist for the loadings of the market premium and the factor SMB (Small minus Big) which seem understated. Daniel and Titman (1997) argue that it is the characteristics rather than the covariance structure of returns that appear to explain the cross-sectional variation in stock returns. According to a study by Cooper et al (2008), a firm’s annual asset growth rate emerges as an economically and statistically significant predictor of the cross-section of the US stock returns. Liu and Zhang (2008) show that the growth rate of industrial production is a priced risk factor in standard asset pricing tests. In many specifications, this macroeconomic risk factor explains more than half of the momentum profits. Their evidence also suggests that the expected growth risk is priced and that the expected growth risk increases with the expected growth. They conclude that risk plays an important role in driving momentum profits. Studies by Kothari, Shanken and Sloan (1995) show that excess market returns (Rm−Rf) explains the variation of security/portfolio returns.

While many studies have been conducted on CAPM in the Western countries, there are a few studies in the Indian context. Studies by Varma (1988), Yalwar (1988), and Srinivasan (1988) have generally supported the CAPM theory in India. Gupta and Seghal (1993), Vaidyanathan (1995), Madhusoodanan (1997), Sehgal (1997), Ansari (2000), Rao (2004) and Manjunatha et al (2006; 2007) have questioned the validity of CAPM in Indian markets. Ansari (2000) has opined that the studies of CAPM on the Indian markets are scanty and no robust conclusions exist on this model. Mohanty (1998; 2002), Sehgal (2003), Connon and Sehgal (2003) have supported the Factors model. Connon and Sehgal (2003) have shown that the Factors model is better than the single factor CAPM in the context of Indian capital market. Manjunatha and Mallikarjunappa (2006) have used five univariate variables (beta, size, BE/ME ratio, EPS/Price (E/P), and Rm−Rf) to test the extent of the influence of these variables on the security/portfolio returns and have found that none of the univariate variables significantly explained the variance of security/portfolio returns with the exception of beta and excess market returns (Rm−Rf) in certain cases.

Hence, this paper proposes to study the effect of two parameter CAPM with different parameters (β and size, β and BE/ME, β and EPS /Price, β and Rm−Rf , size and BE/ME, size and E/P, and E/P and BE/ME) on stock returns in the Indian capital market. Fama and French (1992) have used the combination of β and size, β and BE/ME, β and leverage, and size and BE/ME in the developed capital market. Mohanty (2002) has used the combination of size and market leverage, size and price-to-book value, size and earnings-to-price, size and β in the Indian capital market. The two parameter model
used in this paper is similar to that used by Fama and French (1992).

**THE STUDY**

**Objectives**

This study is undertaken with the following objectives:

- To ascertain the factors that determine the security/ portfolio returns
- To test the empirical validity of the firm-specific factors model as envisaged by Fama and French (1992) and the Market model as envisaged by Kothari, Shanken and Sloan (1995) in the Indian context.

**Hypotheses**

Based on the available evidence on the Standard form of CAPM, Fama and French (1992; 1993; 1996; 1998; and 2002) model, and Kothari, Shanken and Sloan (1995) model, the following hypotheses are formulated:

The null hypotheses are:

- $H_0$: The intercept (Alpha) is not significantly different from zero.
- $H_0$: None of the slope co-efficients of the independent variables, $\beta, \ln(ME), \ln(BE/ME), E/P, \text{ and } R_m-R_f$, in the two parameter regression, is significantly different from zero.
- $H_0$: The firm-specific factors model does not provide a better description of securities returns than that of the standard form of CAPM.
- $H_0$: Market factors model does not provide a better description of securities returns than that of the standard form of CAPM.

The negations of the above null hypotheses are the alternate hypotheses. This study tests the above hypotheses in the Indian context.

**Data and Sample**

The study is based on 30 BSE Sensex companies that were part of the index from 1978-79 to June 30, 2005. However, other companies that replaced a number of companies that are/were part of the Sensex during different times in the history of the index have also been included in the study. The final list of 66 companies is selected based on two criteria: they should have been (a) the constituents of BSE Sensex and (b) traded for minimum six months in a year during the study period. The BSE Sensex companies represent almost 50 per cent of the BSE’s total market capitalization (see Marisetty and Vedpurishwar, 2003), and our sample stocks come from 22 industry groups. These companies are heavily traded on the exchange and come from diverse industry groups. BSE-100 index is taken as the market proxy and the weighted average yields of the Government of India (GOI) securities are used as risk-free rate of returns for the respective years. The daily adjusted share prices, unadjusted closing prices, book value per share, market capitalization, price-to-earnings, earnings per share, number of outstanding shares, BSE-100 index prices, and weighted average yield of GOI securities from January 1, 1990 to June 30, 2005 are used for the study. The methods of computing these variables are explained in the Methodology Section. The data were collected from the Centre for Monitoring Indian Economy (CMIE - Prowess database), BSE, NSE, RBI, SEBI, and the Department of Company Affairs (DCA) websites. Over the years, researchers have used quarterly, monthly, and weekly data to study the empirical relationship in the CAPM. Following Brown and Warner’s (1985) suggestion that daily prices are better as quarterly, monthly, and weekly data do not provide a very meaningful relationship between risk and return, daily price data are used in this study. Only capital gains component has been used in estimating returns, as dividend information of companies is not available for all companies for all the years of the study period. Moreover, ignoring dividends would not pose a serious estimation bias in the light of the fact that the Indian companies exhibit very low dividend yield ratios over the sample period. Further, the BSE-100 index that is used as proxy in the study does not incorporate dividends. Hence, including dividends while estimating security returns would have actually introduced a positive bias in the slope estimates of our time-series regression.

**Methodology: Standard Form of CAPM**

We have used Market model to calculate beta and alpha of the sample companies. This model is used by Black, Jensen and Scholes (1972) and other researchers. Though there are more sophisticated methodologies in this area in the context of developed markets, we have used the methodology of Sharpe (1964), Lintner (1965) and Mossin’s (1968) standard form of CAPM for calculation.
of beta and alpha. We have extensively used the methodology of Fama and French (1992) and Kothari, Shanken, and Sloan (1995) to study the effect of two parameter CAPM with different parameters in the Indian context.

**Phase I: Time Series Regression**

We have calculated percentage and log returns of the sample data. Terregrossa’s (2001) methodology has been used for grouping of sample companies by using three-year period daily returns for the study period and then the intercept ($\alpha_i$) and beta ($\beta_i$) computed for each of the sample periods and companies. For example, the daily prices of the first three years from January 1, 1990 to December 31, 1992 are used for computing the parameters to test the CAPM for the ex-post returns of the year 1993. For the second set of three years, the first year is deleted and one additional year (1993) is added to test the ex-post returns of the year 1994 and so on up to June 30, 2005. The risk measures like alpha and beta are calculated using the following model:

$$ R_i = \alpha_i + \beta_i R_m + e_i, \text{ for } i = 1, \ldots, N \quad \ldots(1) $$

where,

- $R_i$ = Expected return on security ‘i’
- $\alpha_i$ = Intercept of a straight line or alpha coefficient of security ‘i’
- $\beta_i$ = Slope of a straight-line or beta coefficient of security ‘i’
- $R_m$ = Expected return on index m
- $e_i$ = Error term with mean zero and a standard deviation which is constant. This term captures the variations in security ‘i’ that are not captured by the market index $m$.

**Cross-sectional Regression using $\beta_i$ and Size: The Case of Individual Securities**

The variation of security returns may be explained either by one or more independent variables. In this paper, the combination of various independent variables considered to test the variation in security returns is similar to that used by Fama and French (1992). Using securities betas (calculated in Phase I of CAPM) and size as independent variables and $R_i - R_f$ as the dependent variable, a regression is run for the following:

$$ (R_i - R_f) = \alpha + \beta_1 \beta_i + \beta_2 R_{M_t} + e_{i,t} \quad \ldots(2) $$

If the Factors model holds, we expect $\alpha$ to be closer to zero and two variables, $\beta$ and size, to capture the cross-sectional variation in securities returns. The summarized results of the Phase II cross-section regressions are presented in Tables 1 and 2.

**Cross-sectional Regression using $\beta_i$ and (BE/ME)$_i$: The Case of Individual Securities**

We use Fama and French (1992) methodology, and considering securities $\beta_i$ and (BE/ME)$_i$ as independent variables and $R_i - R_f$ as the dependent variable, a regression is run for the following:

$$ (R_i - R_f) = \alpha + \beta_1 \beta_i + \beta_2 \left[ \frac{BE_{i,t}}{ME_{i,t}} \right] + e_{i,t} \quad \ldots(3) $$

If the Factors model holds, we expect $\alpha$ to be closer to zero and two variables, $\beta$ and BE/ME, combine to capture the cross-sectional variation in securities returns (Tables 1 and 2).

**Cross-sectional Regression using $\beta_i$ and E/P$_i$: The Case of Individual Securities**

We use Fama and French (1992) methodology, and considering securities $\beta_i$ and E/P$_i$ as independent variables and $R_i - R_f$ as the dependent variable, a regression is run for the following:

$$ (R_i - R_f) = \alpha + \beta_1 \beta_i + \beta_2 \left[ \frac{E_{i,t}}{P_{i,t}} \right] + e_{i,t} \quad \ldots(4) $$

**Box 1: Definition of Different Variables Used in the Study**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (ln(ME))</td>
<td>Logarithm of market capitalization has been computed by multiplying the daily closing security price with the number of outstanding equity shares.</td>
</tr>
<tr>
<td>Book-to-Market Equity Ratio (ln(BE/ME))</td>
<td>Logarithm of book value of equity-to-market value of equity. The book value of equity has been computed by multiplying the book value per share with the number of outstanding equity shares and market value of equity has been computed by multiplying the daily unadjusted closing price with the number of outstanding equity shares.</td>
</tr>
<tr>
<td>Earnings-to-Price (EPS/Price or E/P) Ratio</td>
<td>Ratio of earnings per share for the accounting year to the daily unadjusted closing equity price.</td>
</tr>
<tr>
<td>Excess Market Returns ($R_m - R_f$)</td>
<td>Excess earnings of market security (BSE-100 index) over the risk-free rate of return (weighted average yield of GOI securities).</td>
</tr>
</tbody>
</table>
Table 1: Cross-Section Regression Results of Security Percentage Returns - Case of Combination of $\beta$ and Firm-Specific Factors

<table>
<thead>
<tr>
<th>Alpha</th>
<th>$\beta$ and Size$_{i}$</th>
<th>$\beta$ and (BE/ME)$_{i}$</th>
<th>$\beta$ and (E/P)$_{i}$</th>
<th>$\beta$ and $R_m-R_f$</th>
<th>Size$<em>{i}$ and (BE/ME)$</em>{i}$</th>
<th>Size$<em>{i}$ and (E/P)$</em>{i}$</th>
<th>E/P$<em>{i}$ and (BE/ME)$</em>{i}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>100</td>
<td>75</td>
<td>75</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>25</td>
</tr>
<tr>
<td>48</td>
<td>25</td>
<td>25</td>
<td>75</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>25</td>
</tr>
</tbody>
</table>

Note: The first row, following the header row, indicates percentage of acceptance of $H_o$ (the co-efficients are more than the chosen level of significance) and in the case of Sig F, it indicates that the regression is not a good fit. The second row, following the header row, indicates percentage of rejection of $H_o$ (the co-efficients are less than the chosen level of significance) and the Sig F indicates that the regression is a good fit. For example, in the above Table 1, $\beta$ and size are not significantly different from zero in 100% of the cases and $F$ ratio of the regression indicates that the regression is not a good fit in 100% of the cases. The reported results of the alpha and slope co-efficients are the results of regressions of each combination of the parameters (i.e., four regressions for each combination of the independent variable as explained in the Methodology and Results sections of the paper). Since reporting of the individual values of the co-efficients would require a large number of tables, only the final results are reported here. The detailed values are available with the authors. Similar explanations hold true for the remaining co-efficients in Tables 1-6.

Table 2: Cross-Section Regression Results of Security Log Returns: The Case of Combination of $\beta$ and Firm-Specific Factors

<table>
<thead>
<tr>
<th>Alpha</th>
<th>$\beta$ and Size$_{i}$</th>
<th>$\beta$ and (BE/ME)$_{i}$</th>
<th>$\beta$ and (E/P)$_{i}$</th>
<th>$\beta$ and $R_m-R_f$</th>
<th>Size$<em>{i}$ and (BE/ME)$</em>{i}$</th>
<th>Size$<em>{i}$ and (E/P)$</em>{i}$</th>
<th>(E/P)$<em>{i}$ and (BE/ME)$</em>{i}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>75</td>
<td>25</td>
<td>75</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>25</td>
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<td>75</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>75</td>
</tr>
</tbody>
</table>

If the Factors model holds, we expect $\alpha$ to be closer to zero and the two variables, $\beta$ and E/P ratio, combine to capture the cross-sectional variation in securities returns (Tables 1 and 2).

**Cross-sectional Regression using $\beta$ and $R_m-R_f$: The Case of Individual Securities**

We use Kothari Shanken and Sloan’s (1995) methodology, and considering securities $\beta_i$ and $R_m-R_f$ as independent variables and $(R_i-R_f)$ as the dependent variable, a regression is run for the following:

$$ (R_i - R_f) = \alpha + \beta_1 \beta_i + \beta_2 R_m - R_f + e_{i,t} \quad \ldots(5) $$

If the Factors model holds, we expect $\alpha$ to be closer to zero and the two variables, $\beta_i$ and $(R_m-R_f)$, combine to capture the cross-sectional variation in securities returns (Tables 1 and 2).

**Cross-sectional Regression using Size$_{i}$ and BE/ME$_{i}$: The Case of Individual Securities**

We use Fama and French (1992) methodology, and considering securities size and BE/ME as independent variables and $R_i-R_f$ as the dependent variable, a regression is run for the following:

$$ (R_i - R_f) = \alpha + \beta_3 R_{E/P_{i}} + \beta_4 \frac{BE_{i}}{ME_{i}} + e_{i,t} \quad \ldots(6) $$

If the Factors model holds, we expect $\alpha$ to be closer to zero and the two variables, size and $(BE/ME)_i$, combine to capture the cross-sectional variation in securities returns (Tables 1 and 2).

**Cross-sectional Regression using Size$_{i}$ and E/P$_{i}$: The Case of Individual Securities**

We use Fama and French (1992) methodology, and considering securities size and E/P as independent variables and $R_i-R_f$ as the dependent variable, a regression is run for the following:

$$ (R_i - R_f) = \alpha + \beta_3 R_{E/P_{i}} + \beta_4 \frac{BE}{ME_{i}} + e_{i,t} \quad \ldots(7) $$

If the Factors model holds, we expect $\alpha$ to be closer to zero and the two variables, size and EPS/Price, combine to explain the cross-sectional variation in securities returns (Tables 1 and 2).

**Cross-sectional Regression using (BE/ME)$_{i}$ and (E/P)$_{i}$: The Case of Individual Securities**

We use Fama and French (1992) methodology, and considering securities BE/ME and E/P as independent variables and $R_i-R_f$ as the dependent variable, a regression is run for the following:

$$ (R_i - R_f) = \alpha + \beta_3 \frac{BE}{ME_{i}} + \beta_4 \frac{E}{P_{i}} + e_{i,t} \quad \ldots(8) $$

If the Factors model holds, we expect $\alpha$ to be closer to zero and the two variables, size and $(BE/ME)_i$, combine to capture the cross-sectional variation in securities returns (Tables 1 and 2).
If the Factors model holds, we expect $\alpha$ to be closer to zero and the two variables, $BE/ME$ and $E/P$, combine to capture the cross-sectional variation in securities returns (Tables 1 and 2).

**Test for Portfolios based on Cross-section Regressions**

The present study has further focused on portfolio analysis as suggested by Markowitz (1952; 1959), Sehgal (1997), Ansari (2000), Fama and French (1992), and Cannon and Sehgal (2003). The following paragraphs test whether independent variables (combined variables) explain the variation in the dependent variable (portfolio returns). Before forming portfolios, all securities are arranged in descending order of their betas in order to form portfolios with high and low beta. A portfolio of 5 securities is made with equal weights and market value weights by considering non-overlapping securities. Portfolios are formed with equal weights as suggested by Lakonishok, Shliefer and Vishny (1994). In this set, Portfolio 1 is formed by choosing the first five securities having highest beta values (securities 1, 2, 3, 4, and 5) and Portfolio 2 is formed by choosing the next five securities (6, 7, 8, 9, and 10) and so on. In the similar way, another set of portfolios are formed with market value weights as suggested by Fama and French (1992). For the purpose of testing CAPM for the first period (three years, 1990-1992), the realized returns on each security for the period January 1, 1993 to December 31, 1993, is used as a measure for expected portfolio returns. Similar method is used for the rest of the test periods January 1, 1994 to December 31, 1994; January 1, 1995 to December 1995; January 1, 1996 to December 1996 (for each year separately) and so on up to January 1, 2005 to June 30, 2005. Similar formulae Nos. 2 to 8 as that of the cross-sectional year-wise regression, is used to study the effect of the independent variables on portfolio returns.

**Company Attributes (Year t and Year t-1 Analysis)**

To test for the ex-post returns of year $t$, we make two assumptions. In the first case, we assume that investors can use values of the independent variables like book equity ($BE$) and market equity ($ME$) (book-to-market equity ratio, $BE/ME$) of year $t-1$ and use this information to make estimation of the returns of year $t$. In the second case, we assume that investors are able to anticipate the values of independent variables like $BE/ME$ of year $t$ and based on these anticipated values, the expected returns are estimated. Based on the above assumptions, we test using first the year $t$ values and later the year $t-1$ values of independent variables.

**Cross-sectional Analysis: Year-wise Regression**

The CAPM is tested by running regressions on the realized returns of the individual years, viz., 1993, 1994, 1995 and so on up to 2005. The security/portfolio’s cross-sectional year-wise regression is done to test the extent of independent variable’s influence on the security/portfolio returns.

**Cross-sectional Analysis: Combined Years Regression**

Since the number of observations was less in the cross-sectional year-wise regression, we run regressions with pooled data of the year-wise regressions (combined years). The first combined year regression is run by taking the data of 1993. The second combined year regression is run by taking the pooled data of 1993 and 1994. The third combined year regression is run by taking the pooled data of 1993, 1994, and 1995. This process is repeated by adding one additional year for the data set to form the combined years observations. The last combined year regression is run by taking the pooled data from 1993 to 2005.

**RESULTS AND ANALYSIS**

**Phase II Test (On the Basis of Cross-section Regression)**

**Test for Intercept (Alpha), Slope of $\beta$ and Size, $\beta$ and $BE/ME$, $\beta$ and $E/P$, $\beta$ and $R_m-R_f$, Size and $BE/ME$, Size and $E/P$, $E/P$ and $BE/ME$ and $F$ Significance**

The present study has been conducted by using a combination of $\beta_i$, size, ln($BE/ME$), $E/P$ and $R_m-R_f$ variables as done in Fama and French (1992) to find out the extent of influence these variables have on security/portfolio returns. The results of the different risk factors are presented in Tables 1 to 6. The intercept and slope co-efficient values are tested using the $t$-test and the overall fit of the regression is tested using the analysis of variance (ANOVA $F$-test) at 5 per cent level of significance.

We have a large number of cross-section regressions for each combined independent variable. When we use securities percentage returns, the number of observations of alpha and slope co-efficients are 4 for each combined independent variable. This is because, we have two regressions when we take year $t$ weights, one regression
for year-wise and the second for combined years; and another set of two regressions when we take the year $t$-1 weights, one (the third) for year-wise and one (the fourth) for combined years. This is the case when we fit two parameter regressions by taking each combined independent variable individually. We count the total number of alpha values that are less/more than the chosen level of significance and then compute the percentage of the total number of alpha values. If a large percentage of $p$-values of alpha are more than the chosen level of significance, we accept the null hypothesis. If the majority of $p$-values of alpha are less than the chosen level of significance, we reject the null hypothesis and accept the alternate hypothesis. Similar procedure is followed for the slope co-efficients of each combination of independent variables. Since we have considered 7 different combinations of independent variables, the total number of cross-section regressions are 2,184 (See Endnotes).

Cross-Section Regression Results of Percentage Returns: The Case of Individual Securities

Table 1 shows that in 52 per cent of the cases, the $\alpha$ values are not significantly different from zero and therefore, we accept the null hypothesis that alpha is equal to zero. The $p$-values of slope co-efficients of the $\beta_i$ and $\ln(BE/ME)_i$ are more than the level of significance and the $F$-test indicates that regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of $\beta_i$ and $\ln(BE/ME)_i$ is not a significant determinant of security returns. The $p$-values of slope co-efficients of the $\beta_i$ and $\ln(BE/ME)_i$ are more than 0.05 and $F$-test indicates that the regression is not a good fit in 75 per cent of the cases. Therefore, we accept the null hypothesis that the combination of $\beta_i$ and $\ln(BE/ME)_i$ do not significantly explain the variation in security returns. The similar results are found in the combination of size and $\ln(BE/ME)_i$. The $p$-values of slope co-efficients of the $\beta_i$ and $E/P_i$ are less than 0.05 and $F$-test indicates that the regression is a good fit in 75 per cent of the cases. This leads us to accept the alternate hypothesis that the combination of $\beta_i$ and $R_m-R_f$ is a significant determinant of security returns. Further, $R_m-R_f$ individually captures the variation in the security returns in 50 per cent of the cases. The $p$-values of slope co-efficient of the $\ln(BE/ME)_i$ are less than 0.05 and the $F$-test indicates that regression is a good fit in 100 per cent of the cases. Therefore, we accept the alternate hypothesis that the combination of size and $\ln(BE/ME)_i$ is a significant determinant of security returns. Further, size individually captures the variation in the security returns in 75 per cent of the cases.

Cross-section Regression Results of Log Returns: The Case of Individual Securities

Table 2 shows that in 75 per cent of the cases, the $\alpha$ values are not significantly different from zero and therefore, we accept the null hypothesis that alpha is equal to zero. The $p$-values of slope co-efficients of the $\beta_i$ and size are more than 0.05 and the $F$-test indicates that regression is not a good fit in 75 per cent of the cases. Therefore, we accept the null hypothesis that the combination of $\beta_i$ and size is not a significant determinant of security returns. The $p$-values of the slope co-efficient of $\beta_i$ and $\ln(BE/ME)_i$ are less than 0.05 and $F$-test indicates that the regression is a good fit in 75 per cent of the cases. Therefore, we accept the null hypothesis that the regression is a good fit in 75 per cent of the cases. The $p$-values of $\beta_i$ and $R_m-R_f$ are more than 0.05 and $F$-test indicates that the regression is not a good fit in 75 per cent of the cases. Therefore, we accept the null hypothesis that the combination of $\beta_i$ and $E/P_i$ do not significantly explain the variation in security returns. The $p$-values of the $\beta_i$ and $R_m-R_f$ slope co-efficient are less than 0.05 and $F$-test indicates that the regression is a good fit in 75 per cent of the cases. This leads us to accept the alternate hypothesis that the combination of $\beta_i$ and $R_m-R_f$ is a significant determinant of security returns. Further, $R_m-R_f$ individually captures the variation in the security returns in 75 per cent of the cases. The $p$-values of slope co-efficient of the $\ln(BE/ME)_i$ are less than 0.05 and the $F$-test indicates that regression is a good fit in 100 per cent of the cases. Therefore, we accept the alternate hypothesis that the combination of size and $\ln(BE/ME)_i$ is a significant determinant of security returns. Further, size individually captures the variation in the security returns in 75 per cent of the cases.
values of the slope co-efficient of size, and \((E/P)\), are less than 0.05 and F-test indicates that the regression is a good fit in 75 per cent of the cases. Therefore, we accept alternate hypothesis that the combination of size, and \((E/P)\), significantly explain the variation in security returns. Further, size individually captures the variation in the security returns in 75 per cent of the cases. The \(p\)-values of the slope co-efficient of \(E/P\), and \(ln(BE/ME)\), are less than 0.05 and F-test indicates that the regression is a good fit in 75 per cent of the cases. This leads us to accept the alternate hypothesis that the combination of \(E/P\), and \(ln(BE/ME)\), is a significant determinant of security returns. Further, \(ln(BE/ME)\) individually captures the variation in the security returns in 75 per cent of the cases.

**Cross-sectional Regression Results of Percentage Returns with Equally Weighted Portfolios**

Table 3 shows that in 85 per cent of the cases, the \(\alpha\) values are not significantly different from zero and therefore, we accept the null hypothesis that alpha is equal to zero. The \(p\)-values of the slope co-efficient of \(\beta_p\), and \(size_p\) are more than 0.05 and the F-test indicates that regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \(\beta_p\), and \(ln(BE/ME)_p\), is not a significant determinant of portfolio returns. The \(p\)-values of the slope co-efficient of \(\beta_p\) and \(ln(BE/ME)_p\) are more than 0.05 and F-test indicates that the regression is not a good fit in 75 per cent of the cases. Therefore, we accept the alternate hypothesis that the combination of \(\beta_p\) and \(size_p\) is significant determinant of portfolio returns. The \(p\)-values of the slope co-efficient of \(\beta_p\), and \(ln(BE/ME)_p\), are less than 0.05 and F-test indicates that the regression is a good fit in 75 per cent of the cases. Therefore, we accept the alternate hypothesis that the combination of \(\beta_p\) and \(E/P_p\) significantly explains the variation in portfolio returns. The \(p\)-values of the slope co-efficient of \(\beta_p\), and \(E/P_p\) are more than 0.05 and F-test indicates that the regression is not a good fit in 75 per cent of the cases. Therefore, we accept null hypothesis that the combination of \(\beta_p\) and \(E/P_p\) does not significantly explain the variation in portfolio returns. The \(p\)-values of the slope co-efficient of \(\beta_p\), and \(R_m-R_f\), are less than 0.05 and F-test indicates that the regression is a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \(\beta_p\) and \(R_m-R_f\) does not significantly explain the variation in portfolio returns. The \(p\)-values of the slope co-efficient of \(E/P_p\) are more than 0.05 and F-test indicates that the regression is not a good fit in 75 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \(E/P_p\) does not significantly explain the variation in portfolio returns.

**Cross-sectional Regression Results of Percentage Returns with Market Value Weighted Portfolios**

Table 4 shows that in 85 per cent of the cases, the \(\alpha\) values are not significantly different from zero and therefore, we accept the null hypothesis that alpha is equal to zero. The \(p\)-values of the slope co-efficient of \(\beta_p\), and \(size_p\) are more than 0.05 and the F-test indicates that regression is not a good fit in 75 per cent of the cases. Therefore, we accept the alternate hypothesis that the combination of \(\beta_p\) and \(ln(BE/ME)_p\) significantly explains the variation in portfolio returns. The \(p\)-values of the slope co-efficient of \(\beta_p\), and \(ln(BE/ME)_p\), are less than 0.05 and F-test indicates that the regression is a good fit in 75 per cent of the cases. Therefore, we accept null hypothesis that the combination of \(\beta_p\) and \(ln(BE/ME)_p\) does not significantly explain the variation in portfolio returns. The \(p\)-values of the slope co-efficient of \(\beta_p\), and \(ln(BE/ME)_p\), are less than 0.05 and F-test indicates that the regression is a good fit in 75 per cent of the cases. Therefore, we accept null hypothesis that the combination of \(\beta_p\) and \(ln(BE/ME)_p\) does not significantly explain the variation in portfolio returns.
Table 3: Cross-sectional Regression Results of Percentage Returns with Equally Weighted Portfolios

<table>
<thead>
<tr>
<th>Alpha</th>
<th>( \beta_p ) and Size (_p)</th>
<th>( \beta_p ) and (BE/ME) (_p)</th>
<th>( \beta_p ) and (E/P) (_p)</th>
<th>( \beta_p ) and ( R_m - R_f )</th>
<th>Size (_p) and (BE/ME) (_p)</th>
<th>Size (_p) and (E/P) (_p)</th>
<th>(E/P) (_p) and (BE/ME) (_p)</th>
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Table 4: Cross-sectional Regression Results of Percentage Returns with Market Value Weighted Portfolios

<table>
<thead>
<tr>
<th>Alpha</th>
<th>( \beta_p ) and Size (_p)</th>
<th>( \beta_p ) and (BE/ME) (_p)</th>
<th>( \beta_p ) and (E/P) (_p)</th>
<th>( \beta_p ) and ( R_m - R_f )</th>
<th>Size (_p) and (BE/ME) (_p)</th>
<th>Size (_p) and (E/P) (_p)</th>
<th>(E/P) (_p) and (BE/ME) (_p)</th>
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slopes co-efficients of (E/P) \(_p\), and ln(BE/ME) \(_p\), are more than 0.05 and F-test indicates that the regression is not a good fit in 75 per cent of the cases. This leads us to accept the null hypothesis that alpha is equal to zero. The \( p \)-values of the slope co-efficients of \( \beta_p \) and size \(_p\) are more than 0.05 and the F-test indicates that regression is not a good fit in 75 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \( \beta_p \) and size \(_p\) is not a significant determinant of portfolio returns. The \( p \)-values of the slope co-efficients of size \(_p\), and ln(BE/ME) \(_p\), are more than 0.05 and F-test indicates that the regression is not a good fit in 75 per cent of the cases. Therefore, we accept the null hypothesis that the combination of size \(_p\) and ln(BE/ME) \(_p\) is not a significant determinant of portfolio returns. The \( p \)-values of the slope co-efficients of size \(_p\) and (E/P) \(_p\) are more than 0.05 and F-test indicates that the regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of size \(_p\) and (E/P) \(_p\) is not a significant determinant of portfolio returns.

Cross-sectional Regression Results of Log Returns with Equally Weighted Portfolios

Table 5 shows that in 82 per cent of the cases, the \( \alpha \) values are not significantly different from zero and therefore, we accept the null hypothesis that alpha is equal to zero. The \( p \)-values of the slope co-efficients of \( \beta_p \) and size \(_p\) are more than 0.05 and the F-test indicates that the regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \( \beta_p \) and size \(_p\) is not a significant determinant of portfolio returns. The \( p \)-values of the slope co-efficients of \( \beta_p \) and ln(BE/ME) \(_p\), are more than 0.05 and F-test indicates that the regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \( \beta_p \) and ln(BE/ME) \(_p\), does not significantly explain the variation in portfolio returns. The \( p \)-values of the slope co-efficients of \( \beta_p \) and (E/P) \(_p\) are more than 0.05 and F-test indicates that the regression is not a good fit in 100 per cent of the cases. This leads us to accept the null hypothesis that the combination of \( \beta_p \) and (E/P) \(_p\), does not significantly explain the variation in portfolio returns.

Cross-sectional Regression Results of Log Returns with Market Value Weighted Portfolios

Table 6 shows that in 93 per cent of the cases, the \( \alpha \) values are not significantly different from zero and therefore, we accept the null hypothesis that alpha is equal to zero. The \( p \)-values of the slope co-efficients of \( \beta_p \) and size \(_p\) are more than 0.05 and the F-test indicates that the regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \( \beta_p \) and size \(_p\), is not a significant determinant of portfolio returns. The \( p \)-values of the slope co-efficients of \( \beta_p \) and ln(BE/ME) \(_p\), are more than 0.05 and F-test indicates that the regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \( \beta_p \) and ln(BE/ME) \(_p\), does not significantly explain the variation in portfolio returns. The \( p \)-values of the slope co-efficients of \( \beta_p \) and (E/P) \(_p\), are more than 0.05 and F-test indicates that the regression is not a good fit in 100 per cent of the cases. Therefore, we accept the null hypothesis that the combination of \( \beta_p \) and (E/P) \(_p\), does not significantly explain the variation in portfolio returns.
portfolio $R_m - R_f$ are less than 0.05 and F-test indicates that the regression is a good fit in 100 per cent of the cases. This leads us to accept the alternate hypothesis that the combination of $\beta_p$ and $R_m - R_f$ is a significant determinant of portfolio returns. The p-values of the slope co-efficients of $size_p$ and $\ln(BE/ME)_p$ are less than 0.05 and the F-test indicates that regression is a good fit in 75 per cent of the cases. Therefore, we accept the alternate hypothesis that the combination of $size_p$, $\ln(BE/ME)_p$, and $R_m - R_f$ is a significant determinant of portfolio returns. The p-values of the slope co-efficients of $size_p$ and $(E/P)_p$ are more than 0.05 and F-test indicates that the regression is not a good fit in 100 per cent of the cases. Therefore, we accept null hypothesis that the combination of $size_p$ and $(E/P)_p$ does not significantly explain the variation in portfolio returns. The p-values of the slope co-efficients of $size_p$, $(E/P)_p$, and $\ln(BE/ME)_p$ are more than 0.05 and F-test indicates that the regression is not a good fit in 75 per cent of the cases. This leads us to accept the null hypothesis that the combination of $(E/P)_p$ and $\ln(BE/ME)_p$ is not a significant determinant of portfolio returns.

**SUMMARY AND CONCLUSIONS**

Investments are made in stock markets in expectation of returns in excess of the risk-free rate. This paper has attempted to test the validity of the combination effect of two parameter CAPM (the combination of two variables — $\beta$ and $size$, $\beta$ and $BE/ME$, $\beta$ and $E/P$, $\beta$ and $R_m - R_f$, $size$ and $BE/ME$, $size$ and $E/P$, $E/P$ and $BE/ME$) on the Indian stock returns. The overall conclusions of this study are summarized as follows:

- The intercept (alpha) is equal to the risk-free rate of returns. This leads to the conclusion that $\alpha$ of the regression is as expected by the CAPM theory. The result shows that the combination of $\beta_i$ and $\ln(BE/ME)_i$, $\beta$ and $(R_m - R_f)_i$, explains the variation in security returns when log return series is used and the combination of $\beta_i$ and $(R_m - R_f)_i$, explains the variation in security returns when percentage return series is used. In case of portfolios, the combination of $\beta_p$ and $(E/P)_p$ and $\ln(BE/ME)_p$ explains the variation in portfolio returns when value weighted portfolios are formed with market value weights using percentage returns. The combination of $\beta_p$ and $(R_m - R_f)_p$ explains the variation in portfolio returns when value weighted portfolios are formed with market value weights using percentage and log returns. However, $\beta$ factor alone, when considered individually in the regressions, does not explain the variation in the security / portfolio returns. This casts doubt on the validity of the CAPM. The results of the present study relating to $\beta$ conform with studies undertaken by Bark (1991), Fama and French (1992), and Harris et al., (2003) on the developed capital market. The results of the beta test also conform with Indian studies undertaken by Cannon and Sehgal (2003).

- The combination of $size_i$ and $\ln(BE/ME)_i$, $size_i$ and $(EPS/Price)_i$, explains the variation in security returns when we use percentage and log returns while only the combination of $size_i$ and $\ln(BE/ME)_i$ explains the variation in security returns when we use percentage returns. In case of portfolios, the combination of $size_p$, $\ln(BE/ME)_p$, and $BE/ME_p$ explains the variation in portfolio returns when value weighted portfolios are formed with market value weights using percentage and log return series. The results of the present study are consistent with the studies undertaken by Banz (1981), Fama and French (1992), and Mohanty (2002).

- The combination of $size_i$, and $\ln(BE/ME)_i$, and $(EPS/Price)_i$, explains the variation in security returns when we use percentage and log returns. In case of portfolios, the combi-
nation of size, and \((BE/ME)_p\) explains the variation in portfolio returns when value weighted portfolios are formed with market value weights using percentage and log return series. The present study also reveals that \(ln(BE/ME)\) has no explanatory power in two parameter regressions (except in the combination of \(ln(BE/ME)\) and \((E/P)_p\)). These results are inconsistent with studies undertaken by Fama and French (1992) on the US capital market. The results of this study are consistent with studies undertaken by Mohanty (2002) on the Indian capital market.

- The combination of size, and \((E/P)_p\), \((E/P)_t\) and \((BE/ME)_p\) explains the variation in security returns when we use log returns. In case of portfolios, none of the combination of \((E/P)_p\) along with other variables explains the variation of portfolio returns when portfolio formed with equal as well as market value weights under both percentage and log returns. \(E/P\) has no explanatory power in two parameter regressions. The results of the present study are inconsistent with the studies of Basu (1983).

- The combination of \(\beta_i\) and \(R_{m}-R_f\) explains the variation in security returns when we use log returns. In case of portfolios, the combination of \(\beta_i\) and \(R_{m}-R_f\) explains the variation of portfolio returns when portfolios are formed with market value weights under both percentage and log returns. When \(R_{m}-R_f\) is included in the two parameter regression, the influence of beta reduces. Also, individually, \(\beta_i\) variable does not significantly explain the variation in security/portfolio returns. However, these combinations start explaining the variation in security/portfolio returns when \(R_{m}-R_f\) is included in the two parameter regression. The results of the present study conform with the study undertaken by Kothari, Shanken and Sloan (1995).

The conclusions are that the alpha is equal to the risk-free rate of returns. The combination of size, and \(ln(BE/ME)\) explains the variation in security returns under both percentage and log returns series; the combination of \(\beta_i\) and \(ln(BE/ME)\), \(\beta_i\) and \(R_{m}-R_f\), \(size_t\) and \(E/P_t\) and \((E/P)\), and \((BE/ME)\) explains the variation in security returns when log return series is used and the combination of \(\beta_i\) and \(R_{m}-R_f\) explains the variation in security returns when percentage return series is used. In case of portfolios, while the combination of \(\beta_p\) and \(R_{m}-R_f\) explains the variation of portfolio returns when portfolios are formed with market value weights under both percentage and log returns, the combination of \(\beta_p\) and \(R_{m}-R_f\) does not explain the variation of portfolio returns when portfolios are formed with equal weights under both percentage and log returns. It is also observed that in majority of the cases, combined variables do not explain the variation of portfolio returns. The empirical findings of this paper would be useful to investors and financial analysts as the results prove that beta alone is not the determinant of security/ portfolio returns in the Indian capital market. As suggested by Pastor (2002), further research on the combination of market factors, firms’ specific factors, and macroeconomic factors is needed to enlarge the understanding of modern finance and to cover fresh ground to unravel the mysteries and ramifications of the CAPM puzzle. There is also a need to test whether the asset growth rate as found by Cooper et al (2008) is a better determinant of the stock returns than book-to-market ratio, excess market returns, beta, and other factors. 

**ENDNOTES**

When we use percentage returns, the total numbers of regressions for each combination of variables is 52. This is because, we have 13 regressions for year-wise (individual years, viz., 1993, 1994, 1995 … 2005) and 13 regressions for combined years when we take year-wise weights; 13 regressions for year-wise and 13 regressions for combined years when we take the weights of year \(t-1\). Similarly, when we use log returns, the total numbers of regressions for each univariate variables is 52. There are 6 types of cross-sectional regressions (cross-section regression results of security percentage returns—the case of combination of \(\beta\) and firm-specific factors; cross-section regression results of security log returns—combination of \(\beta\) and firm-specific factors; cross-sectional regression results of percentage returns with equally weighted portfolios; cross-sectional regression results of percentage returns with market value weighted portfolios; cross-sectional regression results of log returns with equally weighted portfolios; log returns with market value weighted portfolios—(Tables 1-6). Since we have considered 7 combinations of variables as independent variables, we have a total of 2,184 (52 * 7 * 6) regressions.
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T Manjunatha is the Principal of Bapuji Academy of Management & Research (Affiliated to Kuvempu University), in Davangere, Karnataka. He has previously worked in the Department of Business Administration, Bapuji Institute of Engineering & Technology, Davangere, Karnataka; Doddappa Appa Institute of MBA, Gulbarga, Karnataka; Manipal Finance Corporation Ltd., Mumbai; Vinmar Capital Markets Ltd., Mumbai and Chandrakala Money & Capital Management Ltd., Mumbai. He earned his Ph.D., MBA and B.B.M from the Mangalore University. His areas of interest are financial management, CAPM, efficient market hypothesis, and international finance. He has published seven research articles in national and one paper in international journals. He has presented his research papers in both national and international conferences.

e-mail: tmmanju87@rediffmail.com

T Mallikarjunappa is a Professor, Department of Business Administration, Mangalore University, Karnataka, India. He has worked as the Dean, Faculty of Commerce and Chairman of Business Administration and as the Finance Officer of Mangalore University. Initially he worked at the Mangalore Chemicals and Fertilizers Ltd. in Mangalore. He has a Ph.D., an MBA, and a BBM from the University of Mysore. He is also an Associate Member of the ICWAI, Calcutta. His areas of interest are security analysis and portfolio management, CAPM, efficient market hypothesis, mergers and acquisitions, international finance, mutual funds, capital structure theories and derivatives. He has published 51 papers and presented 120 papers in various conferences. He is on the Editorial Board of the AIMS International Journal of Management, published by AIMS International.

e-mail: tmmallik@yahoo.com

My greatest challenge has been to change the mindset of people. Mindsets play strange tricks on us. We see things the way our minds have instructed our eyes to see.

— Muhammad