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An Empirical Analysis of the Capital Asset Pricing Model

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Abstract

Because of the importance of the stock market to the world economy and the rising stature of the Indian economy, we have taken an interest in the Indian stock market. After much consideration, we decided to apply the Capital Asset Pricing Model and the Asset Performance Testing Model to the Indian stock market. Due to the scarcity of scholarly works that specifically address the Bombay Stock Exchange (BSE), we narrow in on this particular market. Using information on the 30 companies that make up the BSE and seven macroeconomic variables, we feed data into regression models based on the CAPM and the APT model to forecast long returns. The Indian stock market could be more susceptible to CAMP or APT model forecasts. The only type of risk considered by the CAPM-based regression model is systemic risk. In our APT-based regression model, we use seven factors, such as daily exchange volume, volatility, and systematic risk. Using data from the Indian stock market, we find that the APT model provides a better factor explanation than the CAPM.

Introduction

To invest is to employ capital with the expectation of profit or growth. Therefore, an investment is a monetary outlay driven by the hope of a monetary gain in the future. When someone makes a purchase with the goal of increasing or maintaining their wealth, they are engaging in the practice of investing. It makes no difference if the asset purchased is cash, a house, gold, or anything else. If the asset is a financial one, such as a stock, debenture, government bond, or mutual fund unit, the returns could be in the form of a regular income, a significant appreciation in value, or a combination of the two. Share price behavior, and in particular the risk-reward relationship in the financial markets, has long piqued the curiosity of academics. In 1905, a young scientist named Albert Einstein developed a brilliant theory based on Brownian motion that he used to demonstrate the existence of atoms. Brownian motion was also explained by Einstein in the same year that he presented his theory of relativity. His research was revolutionary for its time.

Despite the fact that modern financial theory uses systematic factors as sources of risk and expects long-term returns on individual assets to reflect the changes in such systematic factors, very few studies have been undertaken to determine what factors influence the risk and return relationships in the Indian capital market. Therefore, we set out to research how assets prices in the Indian stock market move and how well equilibrium models like APT and the CAPM explain the factors that contribute to the generation of returns on securities.

If the returns on Australian stock indexes can be explained by macroeconomic factors specified in Arbitrage Pricing Theory (APT), Gaoxiang Wang(2008) looked into it. The results of this analysis were derived from ASX equity return data collected between March 31, 2000 and December 31, 2007. Three to five of the thirteen macroeconomic factors analyzed can account for the vast majority of the variance in the returns of the industry indexes. Empirical research reveals that the APT framework's use of macroeconomic elements can help explain consumers' expenditure on discretionary items

including energy, finance, IT, and materials. price index returns are inexplicable, but index returns in general are not. APT is a promising approach for assessing the ASX200 since it can account for the returns of the industry indexes in half of all cases.

In 2010, ErieFebrian and AldrinHerwany conducted research into the viability of CAPM and APT in explaining the enhanced returns of a portfolio of shares traded on the Jakarta Stock Exchange. Data from the years leading up to the crisis (1992–1997), during the crisis (1997–2001), and after the crisis (2001–2007) were analyzed. The results favored APT, indicating that factors other than Beta may account for the excess returns on a portfolio. Even fewer studies have examined the efficiency of stock markets in Asia's emerging economies.

Methodology

In both the CAPM and the APT, a two-stage test is used, as is commonplace in the scholarly literature. The first steps in using the CAPM and the APT are to estimate share betas using time series data and to estimate factor loadings using factor analysis. Second, we test how well the sample mean return matches the CAPM and the APT by doing regressions on the beta (for the CAPM) and the factor loadings (for the APT). The time period covered by this study extends from the beginning of 2010 to the end of 2014.

Objectives

The first step is to perform a CAPM-style risk-return analysis.

As a second step, we must establish the cost-benefit analysis along APT lines in order to:

Evaluate the significance of systematic variables in predicting stock prices and the results of a portfolio

We will evaluate CAPM and APT using simulated data to see which model is better at predicting future returns.

5 Justifying the movement of stock prices.

The sixth goal is to find out if stock prices are affected by macroeconomic trends.

Data Analysis and Interpretation

The current study additionally analyzes the CAPM and APT with fake components using residual analysis to establish which model is preferable in capturing the behavior of share prices in the Indian context.

Normality Test

BSE India monthly share prices for 30 companies are used in the current study comparing CAPM and APT in the Indian market. The BSE30 market index serves as the starting point for the CAPM model's evaluation of security risk. From 2010 to 2014, researchers looked at data. Share price returns (R_{it}) are calculated by subtracting the current stock price (P_t) from the next stock price (P_{t+1}). The formula is as follows:

$$R_{it} = \frac{P_{t+1} - P_t}{P_t} - 1$$

Mean, standard deviation, skewness, kurtosis, and the Shapiro Walk W test for normality are presented in Table-1 for the share price returns of selected companies and the BSE30 market index. Here, we use the Shapiro Walk test to check if the time series of stock prices follows a normal distribution. In addition to skewness and kurtosis, this test can tell you if your data is normally distributed.

Below is a table showing the average ROI for 30 selected businesses between January 2010 and June 2014 (54 months). The values for ROI are between -0.0161 and 0.0273. Only six companies (or their stock values) have exhibited negative returns; the remaining twenty-four have all increased in value.

Table-1: Summary Statistics

| No. | Scrip Name | Mean | SD | Skewness | Kurtosis | Shapiro-Wilk W Test | Normality |
|-----|------------|---------|--------|----------|----------|----------------------|-----------|
| 1 | AXIS | 0.0076 | 0.1188 | 0.1801 | -0.0748 | 0.9763 ^{ns} | 0.5693 |
| 2 | BAJAUT | 0.0184 | 0.0682 | -0.3476 | 0.3782 | 0.9801 ^{ns} | 0.7175 |
| 3 | BHEL | -0.0161 | 0.2289 | 0.8422 | 10.2448 | 0.7977 ^{**} | 0.0000 |
| 4 | BHATE | 0.0048 | 0.0920 | 0.3628 | -0.2459 | 0.9773 ^{ns} | 0.6087 |
| 5 | CIPLA | 0.0056 | 0.0624 | -0.0403 | -0.7246 | 0.9719 ^{ns} | 0.4116 |
| 6 | COALIN | 0.0052 | 0.0795 | 0.8736 | 1.6296 | 0.9579 ^{ns} | 0.1119 |
| 7 | DRREDDY | 0.0178 | 0.0608 | 0.1066 | -0.1888 | 0.9822 ^{ns} | 0.7923 |
| 8 | GAIL | 0.0000 | 0.0568 | -0.2804 | -0.3024 | 0.9723 ^{ns} | 0.4240 |
| 9 | HDFCBNK | 0.0036 | 0.1330 | -4.3700 | 26.7716 | 0.6344 ^{**} | 0.0000 |
| 10 | HEROMOT | 0.0109 | 0.0762 | -0.0849 | -0.0659 | 0.9832 ^{ns} | 0.8279 |
| 11 | HINDAL | 0.0071 | 0.1092 | 0.8167 | 0.6850 | 0.9492 [*] | 0.0440 |
| 12 | HUL | 0.0196 | 0.0669 | 0.7695 | 2.0158 | 0.9699 ^{ns} | 0.3512 |
| 13 | HDFCCOR | -0.0021 | 0.1252 | -4.8802 | 30.8124 | 0.5862 ^{**} | 0.0000 |
| 14 | ICICI | 0.0152 | 0.1044 | 0.4464 | 0.9269 | 0.9780 ^{ns} | 0.6350 |
| 15 | INFOSYS | 0.0090 | 0.0835 | -0.3103 | 0.6843 | 0.9780 ^{ns} | 0.6339 |
| 16 | ITC | 0.0100 | 0.0860 | -3.3792 | 18.4616 | 0.7439 ^{**} | 0.0000 |
| 17 | LT | 0.0076 | 0.1185 | -0.3259 | 2.2186 | 0.9708 ^{ns} | 0.3763 |
| 18 | MAHMAH | 0.0090 | 0.0974 | -2.2738 | 9.1694 | 0.8439 ^{**} | 0.0000 |
| 19 | MARUTI | 0.0153 | 0.1092 | 0.6597 | 0.5428 | 0.9564 ^{ns} | 0.0953 |
| 20 | NTPC | -0.0017 | 0.0840 | 1.9054 | 6.5047 | 0.8611 ^{**} | 0.0000 |
| 21 | ONGC | 0.0001 | 0.1074 | -2.1510 | 12.0106 | 0.8389 ^{**} | 0.0000 |
| 22 | RELIND | 0.0032 | 0.0745 | 0.3122 | -0.5980 | 0.9673 ^{ns} | 0.2787 |
| 23 | SESASTER | 0.0135 | 0.1915 | 0.5755 | 2.7060 | 0.8733 ^{**} | 0.0000 |
| 24 | SBI | 0.0099 | 0.1016 | 0.6002 | 0.3354 | 0.9620 ^{ns} | 0.1696 |
| 25 | SUNPHAR | -0.0008 | 0.1632 | -4.3248 | 23.5509 | 0.5978 ^{**} | 0.0000 |
| 26 | TCS | 0.0217 | 0.0621 | 0.3950 | 0.2023 | 0.9809 ^{ns} | 0.7446 |
| 27 | TATMOT | 0.0273 | 0.1155 | 0.1586 | 0.8460 | 0.9847 ^{ns} | 0.8720 |
| 28 | TATPOW | -0.0159 | 0.1565 | -3.3601 | 19.9856 | 0.7290 ^{**} | 0.0000 |
| 29 | TATSTL | 0.0066 | 0.1273 | 0.5507 | -0.0485 | 0.9601 ^{ns} | 0.1394 |
| 30 | WIPRO | -0.0019 | 0.1030 | -1.0568 | 4.9822 | 0.9351 ^{**} | 0.0090 |

The skewness indicates that only 9 of the 30 stocks even come close to having a normal distribution (generally speaking, a skewness that is either greater than 1.0 or less than -1.0 indicates that the distribution is highly asymmetrical). That is to say, 21 distinct stocks have distributions that are typical with respect to skewness.

The kurtosis for the monthly time series reveals that for 10 stocks, it is greater than 3, while for the other 20 stocks, it is less than 3. In addition, this indicated that the bulk of the animals used in the study behaved normally during the study period.

The results of the Shapiro-Wilk W Test likewise provide strong support for the aforementioned conclusion. Twelve companies (BHEL, HDFC Bank, HDFC Corporation, HINDAL, ITC, MAHMAH, NTPC, ONGC, SESASTR, SUNPHAR, TATPOW, and WIPRO) have a W value that is statistically significant, indicating that their distributions are not normal. During the time period analyzed, the remaining 18 stocks are determined to have followed a normal distribution.

The normalcy test is passed for the BSE 30 market index. Overall, the stock price time series data that were examined showed generally normal behavior over the duration of the study. CAPM Evaluations: Table 2 displays the findings of the analysis. T-values, which are used to determine whether or not an estimated parameter has statistical significance, are supplied in brackets below the coefficient. The table shows that the estimated CAPM model for both periods is statistically significant, with explained variances of 90.58 percent for the first period, 83.80 percent for the second period, and 88.69 percent for the entire period after adjusting for degrees of freedom.

This demonstrates that the chosen stocks have outperformed the market risk during the study period and its sub-periods. Each one-unit increase in market risk was met with an increase in average returns from 30 chosen stocks of 0.8580 units in the first sub-period, 0.8649 units in the second sub-period, and 0.8658 units for the entire study period. The resulting equation for the total study period of January 2010–June 2014 monthly returns of the Indian stock market is:

$$E[R_i] =$$

Table-2: Cross Sectional Regression of Returns

| Period | λ_0 | λ_1 | R^2 | Adj R^2 |
|----------------------|--------------------|---------------------|--------|-----------|
| Jan-2010 to Jun 2012 | -0.0037 -(1.22) | 0.8580** (16.44) | 0.9091 | 0.9058 |
| Jul 2012 to Jun 2014 | 0.0014 (0.41) | 0.8649** (10.96) | 0.8451 | 0.8380 |
| Jan-2010 to Jun 2014 | -0.0014 -(0.63) | 0.8658** (20.22) | 0.8891 | 0.8869 |

**Significant at 1% level*

Figures in parenthesis represents 't' values

Test for the APT

In this study, monthly returns on a sample of 30 equities serve as the dependent variable against which the APT model is evaluated using components derived from principal component factor analysis. The results of a factor analysis are displayed in Tables 3 and 4, which detail the possible number of components underlying the data as well as the factors themselves. Table 3 displays the eigenvalue of the underlying factors of the stocks. The eigenvalue of a factor is the fraction of the total variation in the data that can be explained by that factor alone. A valid factor is one with an eigenvalue greater than one. As can be seen in the table, all of the first eight components have eigenvalues larger than one.

The merged data retains 79.9 percent of the characteristics of the original data. To correctly explain the 30 stocks, then, the first eight components are all that are needed. This image represents the data shown by the Scree plot.

Table-3: Eigenvalue of Factor Components

| Factor | Initial Eigenvalues | | | After Varimax Rotation | | |
|--------|---------------------|------------------|----------|------------------------|------------------|----------|
| | Eigenval | % total Variance | Cumul. % | Eigenval | % total Variance | Cumul. % |
| 1 | 8.8432 | 29.48 | 29.48 | 7.2483 | 24.16 | 24.16 |
| 2 | 2.6661 | 8.89 | 38.36 | 2.5587 | 8.53 | 32.69 |
| 3 | 2.1199 | 7.07 | 45.43 | 2.3649 | 7.88 | 40.57 |
| 4 | 1.9398 | 6.47 | 51.90 | 1.7619 | 5.87 | 46.45 |
| 5 | 1.7545 | 5.85 | 57.74 | 1.6368 | 5.46 | 51.90 |
| 6 | 1.4409 | 4.80 | 62.55 | 1.8037 | 6.01 | 57.91 |
| 7 | 1.3563 | 4.52 | 67.07 | 2.0944 | 6.98 | 64.90 |
| 8 | 1.1172 | 3.72 | 70.79 | 1.7692 | 5.90 | 70.79 |
| 9 | 0.9504 | 3.17 | 73.96 | | | |
| 10 | 0.8936 | 2.98 | 76.94 | | | |
| 11 | 0.7777 | 2.59 | 79.53 | | | |
| | | | | | | |
| 29 | 0.0495 | 0.16 | 99.84 | | | |
| 30 | 0.0477 | 0.16 | 100.00 | | | |

Table-4: Factor Loadings of Stocks

| Stocks | Factor | | | | | | | |
|----------|--------------|--------------|--------------|--------------|---------------|---------------|--------------|--------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| ICICI | 0.866 | -0.024 | 0.097 | 0.138 | -0.028 | 0.196 | 0.202 | 0.043 |
| TATSTL | 0.858 | 0.149 | 0.011 | -0.074 | 0.049 | -0.006 | -0.064 | 0.009 |
| HINDAL | 0.828 | 0.019 | -0.048 | -0.070 | 0.207 | 0.030 | -0.160 | 0.103 |
| SBI | 0.819 | -0.149 | -0.018 | -0.045 | -0.018 | 0.244 | 0.223 | -0.025 |
| LT | 0.772 | -0.253 | 0.164 | 0.082 | -0.138 | 0.053 | 0.282 | 0.093 |
| MARUTI | 0.724 | -0.274 | 0.089 | 0.243 | 0.039 | 0.084 | 0.267 | 0.178 |
| RELIND | 0.683 | 0.159 | 0.314 | 0.119 | 0.102 | -0.054 | 0.034 | 0.185 |
| TATMOT | 0.649 | 0.265 | -0.104 | 0.322 | 0.031 | 0.129 | 0.123 | -0.019 |
| AXIS | 0.616 | 0.037 | 0.206 | 0.231 | -0.347 | 0.302 | 0.258 | -0.128 |
| NTPC | 0.582 | 0.025 | 0.154 | -0.303 | 0.032 | 0.059 | 0.437 | 0.276 |
| TATPOW | 0.566 | 0.036 | 0.269 | -0.072 | 0.062 | 0.165 | -0.015 | -0.136 |
| COALIN | 0.522 | -0.278 | 0.384 | -0.364 | 0.060 | 0.345 | 0.060 | -0.115 |
| HDFCBNK | 0.509 | 0.197 | 0.128 | -0.207 | -0.071 | -0.051 | -0.006 | 0.406 |
| INFOSYS | 0.001 | 0.858 | 0.057 | 0.132 | 0.033 | 0.013 | 0.209 | 0.001 |
| TCS | -0.092 | 0.846 | 0.029 | -0.010 | 0.001 | -0.065 | -0.070 | -0.059 |
| WIPRO | 0.030 | 0.776 | 0.014 | -0.048 | -0.004 | 0.164 | -0.203 | -0.038 |
| ITC | 0.041 | 0.009 | 0.936 | 0.059 | 0.076 | 0.090 | 0.071 | 0.083 |
| HDFCCOR | 0.122 | 0.063 | 0.908 | 0.039 | -0.050 | -0.024 | 0.023 | 0.073 |
| DRREDDY | 0.050 | 0.055 | 0.116 | 0.884 | -0.013 | -0.002 | 0.013 | 0.019 |
| HEROMOT | 0.365 | -0.036 | 0.115 | 0.109 | 0.645 | -0.084 | 0.064 | 0.285 |
| BHEL | 0.078 | -0.023 | -0.046 | 0.129 | -0.543 | 0.058 | 0.230 | -0.212 |
| SUNPHAR | 0.299 | -0.185 | 0.141 | 0.167 | -0.539 | -0.262 | 0.033 | 0.201 |
| BAJAUT | 0.374 | -0.001 | 0.207 | 0.294 | 0.456 | 0.197 | 0.289 | 0.138 |
| BHATE | 0.300 | 0.079 | 0.104 | -0.003 | 0.189 | 0.803 | 0.030 | -0.003 |
| SESASTER | -0.146 | -0.005 | 0.000 | -0.052 | 0.274 | -0.711 | 0.037 | -0.209 |
| MAHMAH | 0.145 | 0.002 | 0.118 | -0.027 | -0.031 | 0.028 | 0.810 | -0.017 |
| ONGC | 0.394 | -0.009 | -0.020 | 0.134 | 0.015 | -0.116 | 0.638 | 0.072 |
| GAIL | 0.327 | -0.011 | -0.029 | 0.432 | 0.069 | 0.295 | 0.444 | 0.277 |
| HUL | 0.031 | -0.161 | 0.083 | -0.004 | 0.210 | 0.064 | 0.119 | 0.846 |
| CIPLA | 0.183 | 0.175 | 0.279 | 0.251 | -0.211 | 0.130 | -0.178 | 0.589 |

Table-5: APT Model
Cross Sectional Regression of Returns

$$\bar{R}_i = \lambda_0 + \lambda_1 \hat{\ell}_1 + \lambda_2 \hat{b}_2 + \lambda_3 \hat{\ell}_3 + \lambda_4 \hat{b}_4 + \lambda_5 \hat{\ell}_5 + \lambda_6 \hat{\ell}_6 + \lambda_7 \hat{\ell}_7 + \lambda_8 \hat{\ell}_8 + \eta_i$$

| Period | λ_0 | λ_1 | λ_2 | λ_3 | λ_4 | λ_5 | λ_6 | λ_7 | λ_8 | R ² | Adj R ² | F Value |
|----------------------|---------------------------|----------------------------|---------------------------|----------------------------|---------------------------|---------------------------|---------------------------|----------------------------|---------------------------|----------------|--------------------|-----------------|
| Jan-2010 to Jun 2012 | 0.0060** (4.05) | 0.0440** (25.21) | 0.0033 (1.60) | 0.0151** (12.55) | 0.0022 (1.36) | 0.0017 (0.94) | 0.0047* (2.39) | 0.0138** (9.70) | 0.0083** (5.17) | 0.9846 | 0.9784 | 159.50** |
| Jul 2012 to Jun 2014 | 0.0076** (4.00) | 0.0397** (14.39) | 0.0056* (2.48) | 0.0172** (4.30) | 0.0103** (5.04) | -0.0020 (-0.96) | 0.0032* (1.96) | 0.0146** (5.08) | 0.0049* (2.05) | 0.9685 | 0.9516 | 57.56** |
| Jan-2010 to Jun 2014 | 0.0070** (5.78) | 0.0406** (33.11) | 0.0062** (5.03) | 0.0152** (12.43) | 0.0068** (5.58) | -0.0022 (-1.83) | 0.0038** (3.12) | 0.0144** (11.71) | 0.0063** (5.11) | 0.9712 | 0.9660 | 185.45** |

*Significant at 5% level; **Significant at 1% level
Figures in parenthesis are 't' values.

Table 4 displays the study's factor loadings, which indicate which of the eight factors the stock is most strongly associated with. When a stock's factor loading is greater than 0.50, it is highly correlated with that factor. After ICICI, TATSTL, HINDAL, and SBI, LT, MARUTI, RELIND, TATMOT, AXIS, NTPC, TATPOW, COALIN, and HDFCBNK all place a heavy emphasis on the first factor. INFOSYS and TCS carry the bulk of the work, with WIPRO coming in at a close third. ITC and HDFCCOR both make sizable contributions to the third factor, whereas DRREDDY has an outsized effect on the fourth. Factor five represents HEROMOT, BHEL, SUNPHAR, and BAJAUT's stocks; factor six, BHATE and SESASTR's; factor seven, MAHMAH, ONGC, and GAIL's; factor eight, HUL's loading; and factor nine, CIPLA's loading. The following table lists the technical aspects of the APT model. The predicted results are shown in Table 5.

In Table 5, we can see that the APT model matches the first two time periods far more closely than the CAPM model does. After accounting for degrees of freedom, the components in the independent set may account for as much as 97.84% of the volatility in the stock price return. The adjusted explained variance for the full study period was 95.16 percent, and for the second sub-period it was 95.16 percent. The explanatory variance shows that APT has outperformed CAPM during the whole research period and in each individual sub-period. The following APT formula was derived from the entire research period of the Indian stock market:

$$E[R_i] = 0.0070 + 0.0406b_{i1} + 0.0062b_{i2} + 0.0152b_{i3} + 0.0068b_{i4} - 0.0022b_{i5} + 0.0038b_{i6} + 0.0144b_{i7} + 0.0063b_{i8} + \xi_i$$

Comparison between CAPM and APT: Residual Analysis

The results of these models are displayed in Tables 6 and 7. Table 7 demonstrates that the regression model for CAPM residuals on the Factor loadings is fitted substantially at the 1% level during the whole 54-month research period, commencing in January 2010 and concluding in June of that year 2014, when the effects of CAPM were taken into account, the APT model still accounted for 24.8% of the residual variation in the full-period model. However, as can be shown from the regression results in Table 6, CAPM is unable to explain the observed time-varying APT residual. This is because, for both the two sub-periods and the full period, the overall fit of the regression model yields negative adjusted R2 values, suggesting unsuitable models.

Table-6: CAPM Model Regression of Residuals of the APT Residuals on Beta

$$\varepsilon_i = \lambda_0 + \lambda_1 \hat{\beta}_1 + \eta_1$$

| Period | λ_0 | λ_1 | R ² | Adj R ² |
|----------------------|-------------|-------------|----------------|--------------------|
| Jan-2010 to Jun 2012 | 0.0003 | -0.0005 | 0.0232 | -0.0129 |
| | (0.24) | -(0.80) | | |
| Jul 2012 to Jun 2014 | -0.0003 | 0.0005 | 0.0115 | -0.0335 |
| | -(0.20) | (0.51) | | |
| Jan-2010 to Jun 2014 | -0.0001 | 0.0001 | 0.0011 | -0.0185 |
| | -(0.08) | (0.24) | | |

*Significant at 1% level: Figures in parenthesis represents 't' values.

Table-7: Regression of Residuals of the CAPM on the Factor Loadings

$$\eta_i = \lambda_0 + \lambda_1 \hat{\ell}_1 + \lambda_2 \hat{\ell}_2 + \lambda_3 \hat{\ell}_3 + \lambda_4 \hat{\ell}_4 + \lambda_5 \hat{\ell}_5 + \lambda_6 \hat{\ell}_6 + \lambda_7 \hat{\ell}_7 + \lambda_8 \hat{\ell}_8 + \varepsilon_i$$

| Period | λ_0 | λ_1 | λ_2 | λ_3 | λ_4 | λ_5 | λ_6 | λ_7 | λ_8 | R ² | Adj R ² | F Value |
|----------------------|--------------------|------------------|--------------------|--------------------|--------------------|--------------------|---------------------|------------------|--------------------|----------------|--------------------|--------------------|
| Jan-2010 to Jun 2012 | 0.0009 (0.36) | 0.0050 (1.64) | -0.0023 (-0.62) | 0.0055** (2.61) | -0.0056 (-1.94) | 0.0010 (0.31) | -0.0069* (-2.00) | 0.0010 (0.40) | -0.0031 (-1.08) | 0.4761 | 0.2665 | 2.27 ^{ns} |
| Jul 2012 to Jun 2014 | -0.0011 (-0.37) | 0.0058 (1.34) | -0.0028 (-0.78) | -0.0037 (-0.58) | 0.0015 (0.48) | -0.0062 (-1.93) | -0.0039 (-1.48) | 0.0007 (0.16) | -0.0016 (-0.42) | 0.4963 | 0.2277 | 1.85 ^{ns} |

| | | | | | | | | | | | | |
|----------------------|------------------|-------------------|--------------------|-------------------|--------------------|--------------------|----------------------|------------------|--------------------|--------|--------|--------|
| Jan-2010 to Jun 2014 | 0.0000 (0.00) | 0.0039* (2.02) | -0.0028 (-1.46) | 0.0047* (2.47) | -0.0011 (-0.59) | -0.0035 (-1.85) | -0.0050** (-2.59) | 0.0015 (0.76) | -0.0026 (-1.36) | 0.3640 | 0.2484 | 3.15** |
|----------------------|------------------|-------------------|--------------------|-------------------|--------------------|--------------------|----------------------|------------------|--------------------|--------|--------|--------|

*Significant at 5% level; **Significant at 1% level

Figures in parenthesis are 't' values.

Factor Structure of Indian Economy

Seven macroeconomic variables, including the IPI, GIP, TRDDEF, FIIS, MONSUP, WSPI, and CPIFORIW, are subjected to principal component technique of factor analysis in order to determine the structure of the Indian economy. The analyzed outcomes are shown in Tables 8 and 9. Table 8 shows that the variation in the original data can be accounted for by the first two components (eigenvalue > 1), and that these two factors combined account for 75.99% of the variance. The macroeconomic state of the Indian economy is shown below, and it reveals two main factors. Scree plots are another visual representation of this. Table 9 displays the factor loadings of each variable with the valid two factors derived from the research, making it possible to identify which component reflects which macroeconomic circumstances. All macroeconomic variables, with the exception of TRDDEF, are first-factor loaded, as shown in the table. Among the factors that have been loaded, MONSUP and CPIFORIW have the highest loadings, followed by WSPI and IPI with high loadings, and finally GIP with a large loading.

Table-8: Total Variance Explained by Factor Components of Macro Economic Variables

| Factor | Initial Eigenvalues | | | After Varimax Rotation | | |
|--------|---------------------|------------------|----------|------------------------|------------------|----------|
| | Eigenval | % total Variance | Cumul. % | Eigenval | % total Variance | Cumul. % |
| 1 | 4.0810 | 58.30 | 58.30 | 4.0810 | 58.30 | 58.30 |
| 2 | 1.2383 | 17.69 | 75.99 | 1.2383 | 17.69 | 75.99 |
| 3 | 0.9945 | 14.21 | 90.20 | | | |
| | | | | | | |
| 7 | 0.0334 | 0.48 | 100.00 | | | |

Table-9: Factor Loadings of Macro Economic Variables

| VARIABLES | FACTOR 1 | FACTOR 2 |
|-----------|----------------|---------------|
| IPI | 0.8526 | 0.3751 |
| GIP | -0.7872 | 0.3567 |
| TRDDEF | -0.0066 | 0.9710 |
| FIIS | -0.2105 | -0.1522 |
| MONSUP | 0.9765 | -0.0053 |
| WSPI | -0.8855 | 0.0640 |
| CPIFORIW | 0.9759 | -0.0105 |

The second factor wholly represents TRDDEF as only this variable is very highly loaded with second factor. The scores of these factors obtained from the analysis are used in the subsequent regression model.

Economic Determinants of Stock Returns

The purpose here is to identify the nexus between the manufactured elements and the broad economic indicators. The factor analysis's classification of the Indian economy is used to inform the selection of economic variables. The development of a set of macroeconomic variables that permits lowest overlapping and maximum quantity of independent information in each variable requires careful selection of variables connected to various artificial causes. The APT model's null hypothesis that the two factors explaining macroeconomic variables are independent is accepted on the basis of these techniques.

$$FS_{jt} = \lambda_0 + \lambda_1 b_{i1} + \lambda_2 b_{i2} + \xi_i$$

Table-10: Regression Results Showing Significance of Economic Variables

| Factor | λ_0 | λ_1 | λ_2 | R ² | Adj R ² | F Value |
|--------|-------------|-------------|-------------|----------------|--------------------|---------------------|
| FS1 | -0.0024 | 0.1598 | 0.1029 | 0.0365 | -0.0020 | 0.95 ^{ns} |
| | -(0.02) | (1.14) | (0.74) | | | |
| FS2 | -0.0005 | 0.0861 | 0.1043 | 0.0186 | -0.0206 | 0.47 ^{ns} |
| | (0.00) | (0.61) | (0.75) | | | |
| FS3 | -0.0031 | 0.0498 | -0.1146 | 0.0154 | -0.0240 | 0.39 ^{ns} |
| | -(0.02) | (0.35) | -(0.82) | | | |
| FS4 | 0.0038 | -0.0985 | 0.0788 | 0.0154 | -0.0239 | 0.39 ^{ns} |
| | (0.03) | -(0.70) | (0.56) | | | |
| FS5 | 0.0043 | -0.1001 | 0.1046 | 0.0204 | -0.0188 | -0.52 ^{ns} |
| | (0.03) | -(0.71) | (0.75) | | | |
| FS6 | 0.0055 | -0.1421 | 0.1152 | 0.0324 | -0.0063 | 0.84 ^{ns} |
| | (0.04) | -(1.01) | (0.83) | | | |
| FS7 | -0.0008 | 0.1089 | 0.1211 | 0.0270 | -0.0119 | 0.69 ^{ns} |
| | -(0.01) | (0.77) | (0.87) | | | |
| FS8 | -0.0011 | -0.0079 | -0.0803 | 0.0066 | -0.0332 | 0.17 ^{ns} |
| | -(0.01) | -(0.06) | -(0.57) | | | |

**Significant at 5% level; Figures in parenthesis are 't' values.*

The results of the regression are exhibited in Table 10. It is surprising to see the results reported in the table that none of the models is explained significantly by macro-economic factors. This indicates that the shares are not priced for status of Indian economic during the period under study.

Conclusion

The results of the APT-based regression analysis suggest that the independent components could explain for 97.84%

of the variation in the stock price return in the initial sub-period after correcting for degrees of freedom. For the full study period, the adjusted explained variance is 96.60 percent, while for the second sub-period, it is 95.16 percent. It is clear from this table that the APT is superior to the CAPM when applied to the Indian stock market. APT outperforms CAPM in the Indian stock market because it accounts for risk associated with the market portfolio in addition to risk bearing on extra systematic elements.

The major purpose of this study was to compare the CAPM with the APT using residual analysis to see which model more accurately explains the data. Based on these results, it can be concluded that the CAPM's residuals on the Factor loadings were fitted significantly at the 1% level during the whole 54-month study period starting in January 2010 and concluding in June 2014. In addition, the APT is anticipated to account for the 24.84 percent of the volatility in the return on share prices that cannot be explained by CAPM. However, it is found that CAPM does not fully explain the variance in stock returns that are not explained by APT. Therefore, APT provides a more satisfactory explanation for the return on investment in the Indian stock market than does CAPM. Regression of artificial factors with macro-economic variables chosen using the factor analysis's classification of the Indian economy reveals that macroeconomic factors cannot account for the returns on investment in the Indian stock market. Factor analysis of macro-economic variables likewise reveals that, with the exception of the trade deficit, most other macro-economic variables in the Indian economy follow a similar pattern. The overall complex behavior of share portfolio returns in the Indian stock market cannot be well explained by market risk alone, it is shown. The performance of a portfolio is also heavily influenced by a number of other systemic elements. However, macro variables in the Indian economy cannot be used to predict the behavior of share price return series in the Indian stock market. Both academics conducting future research in this area and stock market participants can benefit from the findings of the current study. This examination of CAPM and APT was conducted using thirty different equities. A larger sample size, however, may allow for more economic aspects to be investigated and a more robust generalization to be attained. Cluster analysis can also be used to categorize different kinds of businesses based on their impact on the economy.

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