Unconditional Asset Pricing Models: Performance of Indian Equity Mutual Funds

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ABSTRACT

This study evaluates the performance of Indian Mutual Funds using various risk-adjusted models. Here we used 167 actively managed equity schemes over fourteen years retrieved from the most prominent openly available database maintained by the AMFI since its inception. Instead, we used the daily data rather than the low-frequency monthly or quarterly data. The active managers make decisions proactively regarding macroeconomic events, which the high-frequency data can better explain. We have estimated scheme-wise and the overall performance using CAPM, Fama-French, Carhart, 3M, and 4M models. Results contribute to the literature by proving the existence of superior Indian fund performance. Further, the study concludes that the 4M model is a better model for capturing the performance of Indian Mutual Funds.

Keywords: Performance Evaluation, Risk -Adjusted Models, Indian Mutual Funds, AMFI

INTRODUCTION

One reason why investors favor mutual funds is their potential to yield superior returns compared to alternative investment avenues. The ability to produce surplus returns is a crucial aspect of their professed proficiency in fund management, which can be substantiated using a return- or holding-based analysis. The initial approach relies on historical returns, whereas the other approach necessitates a significant amount of holding data. These methods have been previously discussed in the scholarly literature by Sharpe (1963, 1966), Jensen (1968), E. F. Fama and French (2015), F. Fama and French (1993), and Carhart (1997). Multi-factor asset pricing models possess inherent advantages that prompt scholars to concentrate on this domain.

Sharpe (1963) introduced the Capital Asset Pricing Model (CAPM) as the initial framework that prioritizes market exposure over a risk-free return through the standard portfolio. Jensen (1968) incorporated an alpha intercept in the model that accounts for the idiosyncratic shocks. The model addressed the principal issues of suboptimal portfolio performance through the utilization of Jensen's alpha (Huberman & Kandel, 1987; E. F. Fama & French, 2015; F. Fama & French, 1993; Carhart, 1997).

The works of E. F. Fama and French (2015), F. Fama and French (1993), and Carhart (1997) have raised skepticism regarding the ability of a manager to produce higher returns using one market factor. It necessitates establishing more complex models that incorporate multi-factors. To address the issue, the literature suggests emphasizing the Higher-order moments, such as skewness and kurtosis exposures (Kraus & Litzenberger, 1976; Harvey & Siddique, 2000; Fang & Lai, 1997). Firstly, Kraus and Litzenberger (1976) and Harvey and Siddique (2000) include the co-skewness component, i.e., the squared excess market return, in Jenson's model, which has been shown to impact the investment decisions made by managers. Fang and Lai (1997) and Hung et al. (2004) incorporated Kurtosis factors into the covariance and skewness terms of their models to underscore their significance.

Huberman and Kandel's work from 1987 serve as evidence in the literature for the necessity of multifactor factor models. Fama and French subsequently introduced the three-factor model (FF model) in 1993 and 1994, which incorporates value and size exposures. The stocks' exposure to the value component suggests the presence of selectivity biases. A positive exposure implies a predilection for assets with high value, while a negative exposure implies a preference for high-growth stocks. In the FF model, Carhart (1997) added a momentum factor that Jegadeesh and Titman (1993) had originally proposed. The concept of momentum indicates a positive inclination towards acquiring equities and a negative inclination towards those that are declining. The Fama-French-Carhart asset pricing model incorporates the effects of firm size, book-to-market ratio, and momentum in explaining stock returns. If partiality is detected, this particular model can compute performance that has been adjusted for risk. Even though the models had left out the time-varying character of beta. Without this, it accounted for cross-sectional effects and postulated a constant beta across the time frame. However, this assumption resulted in statistically insignificant outcomes, as reported by Bauer

et al. (2005), Leite and Cortez (2015), Renneboog et al. (2008), and Schröder (2004).

A comprehensive investigation was conducted on several aspects of US Mutual from various dimensions. However, the history of mutual funds in India dates back over half a century to the establishment of UTI's unit scheme US 64 in 1964. Despite its longevity the Mutual Funds in India needs literature on the empirical and theoretical aspects. As of mid 2025, there are 44 active Asset Management Companies (AMCs) with a total of INR 74.41 trillion in assets under management. 215 million out of 235 million folio holders (91%s) were retail investors. Rapid expansion has been a hallmark of the industry during the last half-century.

The study conducted by Babbar and Sehgal (2018) employed the conditional Carhart (1997) model to examine the influence of fund characteristics on mutual fund performance. The study analyzed the extent to which the characteristics of the fund account for the observed performance, utilizing daily data. Previous research has utilized infrequent data and has concentrated on fund attributes such as ownership arrangement, investment goals, portfolio composition, and past returns (ALEKHYA, 2012; Arshadeep, 2011; Bawa & Brar, 2011; Dhar, 2013; Garg, 2014; Pandey & Sudesh, 2005; Panwar & R. Madhumathi, 2006). Numerous scholarly investigations have focused on traditional approaches for evaluating fund performance, including Sharpe, Treynor, and Jensen alpha, typically at monthly or quarterly intervals (ALEKHYA, 2012, Arshadeep 2011; Panwar & R. Madhumathi, 2006; Prasad & Prasad, 2012). The utilization of high-frequency data is more effective in describing market risk exposure compared to low-frequency data due to the continuous nature of market risk exposure. The effectiveness of the fund was determined by Kaur (2018) through the utilization of the Conditional-Carhart model (1997) in conjunction with the OLS estimation technique. Misra and colleagues (2019) expanded the co-skewness and co-kurtosis elements in the context of the Capital Asset Pricing Model (CAPM), the three-factor model, and the Carhart model. The results of their study demonstrate the significance of the co-skewness and co-kurtosis parameters.

This study expands the utilization of higher-order moments in the benchmark risk-adjusted models applied to Indian equity funds. The research aimed to evaluate the performance of MF by utilizing scheme-level data from a sample of 167 open-ended equity schemes over 14 years, from April 3rd, 2006, to December 31st, 2019. The primary aim of this paper is to examine the alternative risk-adjusted models utilized in evaluating the performance of Mutual Fund institutions in India. The findings have the potential to provide valuable insights to investors and managers in their pursuit of identifying the most lucrative investment opportunities. Moreover, the study utilized various asset pricing models and assessed their appropriateness within the Indian context. The noteworthy implication of the study is the substitution of monthly or quarterly data with daily data for the assessment of fund performance. An additional contribution of the research lies in its utilization of the openly accessible data source of AMFI, which has been available since its establishment in 2006. The paper employed year-wise alpha to examine the performance of funds and the business cycle's response in addition to the overall analysis.

Following the introductory session, the article is organized into the following sessions: the second session deals with the data & Methodology; in the third session, the empirical models are discussed in detail; the fourth session covers the result and discussion. The conclusion comes in the last session.

DATA& METHODOLOGY

This research employed a dataset covering a period of 14 years, specifically from April 3, 2006, to December 31, 2019. The data was sourced from 167 actively managed equity investment schemes in India, which included open-ended schemes in the large, mid, and small-cap categories. The Net Asset Values (NAV) for various schemes were obtained from the online data repository of AMFI, starting from its inception on April 3rd, 2006. The daily returns are obtained by applying equation 2.a to the NAV. The Fama-French Factor for India website, which is hosted by IIM Ahmadabad and curated by Agarwalla et al. (2013), provides data on the return on value, size, and momentum of portfolios. This data is free from survivorship bias and is comparable to the data library for developed economies developed by Kenneth R. French. Both the risk-free return and the market return are sourced from the same source. The entirety of the information is presented in daily frequencies.

$$R_{scheme} = \frac{Nav_t - Nav_{t-1}}{Nav_{t-1}} = R_{p,i} \qquad (2.a)$$

$$here$$

$$R_{scheme} = scheme \quad return$$

$$Nav = Net \quad Asset \quad Value$$

$$t, t-1 \rightarrow successive\, time \quad periods$$

The Table 1 shows the summary of the variable used in unconditional Pricing Models

The excess portfolio return is the difference between the scheme return and the risk-free return. The market premium is calculated by subtracting the risk-free rate from the market return. The return of the size, value, and momentum portfolios represents small minus big

portfolios, high minus low portfolios, and winner minus loser portfolios. Our approach did not prioritize the development of size, value, and momentum factors, but rather adhered to the methodology established by Agarwalla et al. (2013).

According to Babalos et al. (n.d.), the existing literature proposes several metrics such as the Sharpe ratio, Jensen's alpha, the intercept of the OLS measure, and its augmented versions such as Carhart alpha, Fama-French three-factor alpha, and five-factor alpha. The utilization of performance measures is employed to distinguish stocks that are either profitable or unprofitable. The investigation employed augmented versions of Jensen's alpha to evaluate the stock-picking proficiency of fund managers, as previously conducted by Elyasiani and Jia (2011) and Turtle and Zhang (2012). The manifestation of enhanced performance is observable through the alpha intercept, and its corresponding t-statistic. To comprehensively assess performance, the joint alpha is estimated through Ordinary Least Squares (OLS) estimation. The following are the proposed test hypotheses: -

Scheme-wise Performance

H0: $\alpha_1 = \alpha_2 = \alpha_3 = ... = \alpha_{167} = 0$ (Alpha is not significantly different from zero)

H1: the alpha is significantly different from zero $(\alpha \neq 0)$

The overall performance of the schemes is tested using the following hypothesis

H0: The jointly estimated alpha is not significant $(\bar{\alpha}_{1to167} = 0)$

H1: The joint alpha is significantly different from zero

The OLS regression is done for each scheme independently and the results are reported in the later section. In addition to the time series analysis, the study has estimated year-wise joint alpha to see the performance persistence.

EMPIRICAL MODELS

A detailed discussion on different models is given under,

Single Factor Model (Sharpe, 1964) - the model is considered fundamental for measuring the Portfolio return. The portfolio return $R_{p,i}$ is calculated by adding the market premium factor $\beta(R_m - R_f)$ to the risk-free rate of return R_f as shown in the equation (3.1).

$$R_{p,i} = R_f + \beta(R_m - R_f) -------(3.1)$$

β of model accounted for the exposure to the systematic risk, and the scheme-specific return factor was absent. When Jenson added the intercept term alpha to the model, it became more efficient in explaining the observed returns (3.2).

$$R_{p,i} - R_{f,i} = \aleph + \quad (R_{m,i} - R_{f,i}) + \quad _i -------(3.2)$$

The term α-intercept will capture the superior performance of the model.

Three moment asset pricing model (3M Model)

As shown in the equation (3.3), the Jenson's original model gets its first extension with the squared market premium for capturing the Skewness factor.

$$R_{p,i} - R_{f,i} = \alpha + \beta(R_{m,i} - R_{f,i}) + \gamma(R_{m,i} - R_{f,i})^2 + \varepsilon_i ----------(3.3)$$

The coefficient γ of squared market premium will capture the Co-Skewness factor.

Four moment asset pricing model (4M Model)

Later the cubic market premium factor will be added to the (3.3), now it captures the Co-Kurtosis. The model becomes.

$$R_{p,i} - R_{f,i} = \alpha + \beta(R_{m,i} - R_{f,i}) + \gamma_1(R_{m,i} - R_{f,i})^2 + \gamma_2(R_{m,i} - R_{f,i})^3 + \varepsilon_i ----------(3.4)$$

Fama-french three factor model (1993, 94)

Fama & French developed a multi factor model by incorporating the size and value factors into the popular theoretical model of William Sharpe. The study uses the return calculated from the value and the size portfolios extracted from the Fama-French-Momentum Factor library for India (IIMA). Their data has a wide coverage of most of the firms in the Centre for Monitoring Economy (CMIE) database (Agarwalla et al., 2013). Size and value portfolios are created by taking the natural log of the Asset under Management (AUM), and the Book to Market ratio (B/M ratio).

$$R_{p,i} - R_{f,i} = \alpha + \beta_1(R_{m,i} - R_{f,i}) + \beta_2 R_{SMB} + \beta_3 R_{HML} + \varepsilon_i ----------(3.5)$$

(R_{SMB}) stands for the return of Small minus Big portfolio. It is portfolio zero investment portfolio having short position in large cap stocks and long position in small cap stocks. R_{HML} The represents the return of the high minus low portfolio's with zero investment having long position in high book to market (B/M) stocks and short position if the B/M of the stocks are low. Both the terms represent the size and value factors respectively.

Carhart four factor Model (1997)

Carhart extended the Fama-French three factor model with the momentum factor. The Momentum factor is

originally proposed by the Jagathees et al. Now the model becomes the

$$R_{p,i} - R_{f,i} = \alpha + \beta_1(R_{m,i} - R_{f,i}) + \beta_2 R_{SMB} + \beta_3 R_{HML} + \beta_4 R_{WML} + \varepsilon_i \text{----------} (2.6)$$

R_{WML} represent the winner minus loser portfolio having a zero investment in the securities.

RESULTS AND DISCUSSION

Panel A of Table 2 represents the cross-sectional descriptive statistics of the variables. The mean return of the scheme (excess of risk-free returns) is 4.6603, with a standard deviation of 39.807. The mean and standard deviation of market returns are 0.01871 and 1.10349, respectively. The average return of the size and the momentum factors are 2.75E-05 and 0.0792, respectively. Whereas the average return of the value factor is found to be -0.0116. The mean squared and cubic values of the market premium are 1.217832 and -0.733369, respectively. The data for market, size, value, and momentum factors are extracted from the website of Fama French Factors for India, maintained by IIM Ahmadabad, similar to the Kenneth R. French data library for developed markets.

The scheme returns (cross-sectional) and the returns of the value factors are found to be positively skewed, whereas the market return, the returns of size, and the returns of the momentum factors are found to be negatively skewed. This indicates the non-normality of the variables. The Kurtosis is estimated to measure the peak of normally distributed variables. The results exhibit a greater value for kurtosis than the standard value of three. This indicates that the variables are leptokurtic. Normality is a fundamental assumption for every econometric analysis. In order to check for normality, we estimated the Jarque-Bera statistics. The results accept the statistical significance of the null hypothesis that the variables are not normal at the 1%, 5%, and 10% levels of significance.

The pair-wise correlation between variables is reported in Panel B of Table 2. Scheme-wise excess return, excess market return, return of size portfolio, return of value portfolio, return of momentum portfolio, skewness factor, and kurtosis factor are used as the variables. The results of the cross-correlation established mixed evidence for positive and negative correlations. But the results indicate a weak relationship between variables. A positive correlation is established between market return and scheme wise return; scheme-wise return and SMB; market return and HML; and SMB and WML. A negative correlation is estimated between SMB and market return; scheme-wise return and HML; SMB and HML; WML and scheme-wise return.

The estimated intercept values for various models, including CAPM, 3M model, 4M model, Fama-French three factor model, and Carhart four factor models, are not presented for the sake of brevity. The models regress the return with market return, return of size, value and momentum portfolio. The t-statistics is used for estimating the significance of the variables. In all cases, the intercepts are positive integers greater than zero. The outcome will result in the null hypothesis being rejected, as it has been determined that the intercept holds no significance across all instances. To clarify, the research acknowledges the manager's capacity to produce a higher rate of return, and it is noteworthy that the intercept α maintains a positive value over the entire duration of the study. The intercept α may be considered as a metric for evaluating the risk-adjusted performance specific to a particular fund.

Table 3 presents the estimated alpha values every year, to comprehend the manager's performance across various stages of the business cycle. All reported years exhibit positive performance, except 2007. In the specified time frame, the managerial performance exhibited a negative intercept and an insignificant p-value, as determined through the utilization of both the 4-M and 3-M models. The outcomes are derived through the utilization of pooled ordinary least squares (OLS) estimation, along with the time series regression.

Table 1: Shows the summary of the variables of the unconditional models

Model	Dependent variable	Independent variables
CAPM	Portfolio Excess Return	Market Premium ($R_m - R_f$)
Three Moment Asset Pricing Model	Portfolio Excess Return	Market Premium($R_m - R_f$), Squared market premium $(R_{m,i} - R_{f,i})^2$
Four Moment Asset Pricing Model	Portfolio Excess return	Market Premium($R_m - R_f$), Squared market premium $(R_{m,i} - R_{f,i})^2$ and the cubic market premium $(R_{m,i} - R_{f,i})^3$
Fama-French three-factor Model	Portfolio Excess Return	Market Premium, Return of SMB Portfolio, and the Return of the HML Portfolio
Carhart four-factor Model	Portfolio Excess Return	Market Premium, Return of SMB Portfolio, and the Return of the HML portfolio and Return of WML portfolio

The table shows the summary of the variable used in unconditional Pricing Model

Table 2: Showing the overall characteristics of the overall data

Panel A: Showing the Descriptive Statistics of the data							
	Excess return	$R_m - R_f$	**SMB**	**HML**	**WML**	$(R_{m,i} - R_{f,i})^2$	$(R_{m,i} - R_{f,i})^3$
Mean	4.660301	0.01871	2.75E-05	-0.0116	0.0792	1.217832	-0.733369
Std. Dev.	39.80733	1.1034	0.76202	1.00984	0.87429	3.695476	28.81507
Skewness	22.98294	-0.5968	-0.6079	0.78838	-0.5145	15.43861	7.388615
Kurtosis	979.1858	10.2526	8.41998	14.4573	8.79016	476.1469	3781.879
Jarque-Bera	1.39E+10	784749	448179	1942884	502367	3.27E+09	2.07E+11
Probability**	0	0	0	0	0	0	0
Number of observations	348423	348615	348615	348615	348615	348615	348615

**P-value is tested for 1%, 5% and 10% level of significance

Panel B: Pair wise correlation between variables							
	Excess return	$R_m - R_f$	**SMB**	**HML**	**WML**	$(R_{m,i} - R_{f,i})^2$	$(R_{m,i} - R_{f,i})^3$
ERFW	1						
$R_m - R_f$	0.020945	1					
SMB	0.003802	-0.2973	1				
HML	-0.00149	0.3127	-0.0459	1			
WML	-0.00046	-0.2499	0.09455	-0.2552	1		
$(R_{m,i} - R_{f,i})^2$	-0.01549	-0.1855	-0.0733	-0.0749	-0.0068	1	
$(R_{m,i} - R_{f,i})^3$	0.00442	0.4766	-0.1621	-0.0048	-0.0941	-0.3541072	1

Source: author's calculation using E-views software

Table 3: Showing year wise alpha intercept estimated using different models

Year	CAPM	FF Model	Carhart	3M Model	4M Model
2006	2.1282470	2.1702440	2.1661960	1.674020	1.778930
2007	1.644480	1.431853	1.347879	0.153294 0.322**	-0.199951 0.2004*
2008	1.3306310	1.8020020	1.8196460	1.7428170	1.7426420
2009	1.1612660	1.0947450	1.0841580	1.0262170	1.0277260
2010	1.9763310	1.9709780	1.8731740	1.276830	1.3628190
2011	2.1851050	2.1912070	2.1731930	1.5461580	1.5564250
2012	8.3486570	8.7031890	9.1251430	10.112080	10.093750
2013	7.28760	7.2598860	7.2330420	9.2801340	9.4118340
2014	6.4226010	6.0122360	5.9689110	6.2022430	5.973870
2015	3.8521630	3.3648240	3.2522280	3.8409220	3.8439460
2016	4.4732490	4.4874870	4.4744720	5.3623650	5.4173310
2017	6.302060	6.2210940	6.3476060	7.1507870	7.4425940
2018	4.6356340	4.9935010	4.9511160	4.5482740	4.5494410
2019	3.6827680	3.7508740	3.6489830	3.7399890	3.8943830

Year wise pooled OLS results of the different models

The summary results of the time series regression are given in the Panel A of Table 4. In case of CAPM, the average α and β coefficients are 4.723776 and 0.580362 respectively. The α intercept is found to be positive in all the cases. The Fama French three factor model reports a negative value for the mean β_3 i.e., -0.2218. The average value of intercept is 4.732878 and the average values of β_1 and β_3 are 0.784876 and 0.768283. All the schemes are having a positive α intercept whereas a total of 147, 155 and 49 schemes are reported with positive β_1, β_2 and β_3 coefficients.

In four factor model, the average of β_3 is found to be negative and the 95 schemes out of 167, were reported a negative β_3. This is a clear indication of negative response to the value factor. Here also the α is positive with respect to all the schemes. In 3-M and 4-M models, the mean of the co-Skewness factor is found to be negative. Here the value of α 's is found to positive.

The overall performance is analyzed using the average α i.e., $\overline{\alpha}_{1to167}$. The average α is found to be none-zero integer in all the cases. This has led to the rejection of null hypothesis and accepts the significance of intercept α for generating superior returns.

Panel B of the table 4, shows the summary statistics of the time series regression. Adjusted R^2 is used as

Table 4: Panel A : showing the summary results of the time series analysis

CAPM					
	Alpha	**Beta**			
Average Coef:	4.723776	0.580362			
No: of positive	167	146			
No: of Negative	-	21			
Fama-French 3 Factor Model					
	Alpha	B1	B2	B3	
Average Coef:	4.732878	0.784876	0.768283	-0.2218	
No: of positive	167	147	155	49	
No: of Negative	0	20	12	118	
Carhart four factor model					
	Alpha	B1	B2	B3	B4
Average Coef:	4.698163	0.853217	0.803932	-0.0434	0.456453
No: of positive	167	**146**	**159**	**72**	**119**
No: of Negative	0	**21**	**8**	**95**	**48**
3M-Model					
	Alpha	Beta	Gama		
Average Coef:	4.91925	0.588634	-0.20233		
No: of positive	167	146	18		
No: of Negative	0	21	149		
4M-Model					
	Alpha	Beta	G1	G2	
Average Coef:	4.916868	0.845638	-0.20227	-0.05383	
No: of positive	167	152	18	20	
No: of Negative	0	15	149	147	

Calculation using E-views software

model selection criteria, i.e., high value is preferred for a better model. The negative value (adj. R^2) indicates the irrelevance of the model. In CAPM, more than fifty percent of the schemes were rejected the model with 161 significant F value Both the Fama French and the Carhart Models shows a significant F-value for all the schemes with higher number of negative adj. R^2. Out of the five models that were evaluated, the Four Momentum model was determined to be superior based on its higher number of positive Adjusted R2 values and significant F-value. Within this framework, it can be observed that each of the schemes exhibits a positive Adjusted R2 and a statistically significant F-value.

The overall model summary is shown in the Table 5. The model selection is based on the highest value of average adjusted R^2 and average P- Value. Fama-French and Carhart models are reported with negative adjusted R^2 value. In case of CAPM, the adjusted R^2 is found to be positive and the P-value is significant. The 4M-model is found to have a superior adjusted R^2 value and significant P-value. The 4M-Model is found to be better in Indian context and this signifies the relevance of Kurtosis and Skewness factors altogether with the market return.

Table 4: Panel B Showing summary results of the time series regression

CAPM		
Adj.R^2	No. of positive cases	83
	No. of negative cases	84
F-Prob.	Significant	161
	Insignificant	6
Fama-French 3 Factor Model		
Adj.R^2	No. of positive cases	55
	No. of negative cases	112
F-Prob.	Significant	167
	Insignificant	0
Carhart four factor model		
Adj.R^2	No. of positive cases	**51**
	No. of negative cases	**116**
F-Prob.	Significant	**167**
	Insignificant	**0**
3M-Model		
Adj.R^2	No. of positive cases	76
	No. of negative cases	91
F-Prob.	Significant	165
	Insignificant	2
4M-Model		
Adj.R^2	No. of positive cases	167
	No. of negative cases	0
F-Prob.	Significant	167
	Insignificant	0

Author's calculation using E-views.

Table 5: Showing overall results of the model

	CAPM	FF	Carhart	3M	4M
Adj. R^2	0.00011	-0.0004817	-0.00042	-0.0002	0.0020014317
F-Prob	0.389692	0.5224555	0.554688	4.52E-01	0.574074

Computation using E-views software

CONCLUSION

This study aims to assess alternative benchmark models that have been adjusted for risk, with a particular emphasis on analyzing daily data at the scheme level. There is a dearth of literature about Mutual Fund performance in the Indian context. In this study, a total of 167 equity mutual fund schemes that are actively managed are taken into consideration. The returns of the scheme are evaluated and subjected to regression analysis concerning various factors, namely market, size, value,

momentum, Co-Skewness, and Co-Kurtosis. This is carried out across different models, including Single Index, Fama-French three-factor, Carhart four-factor, and 3M and 4M. The results of the time series regression demonstrate compelling evidence for the superior performance of managers, thereby establishing a strong indication of their stock-picking ability.

Furthermore, an evaluation and examination of joint intercept are conducted to assess the overall efficacy. The findings suggest compelling evidence supporting the notion of superior managerial aptitude in alignment with existing literature. In the context of India, it has been determined that the 4-M Model exhibits greater efficacy compared to other models such as the CAPM, Fama-French, Carhart, and 3-M models. The regression analysis of the time series data reveals a noteworthy adjusted R2 value and statistically significant F-values for the 4-M model. The 4M model exhibits a higher adjusted R2 value and a statistically significant P-value. The 4M model has been observed to exhibit superior performance within the Indian context.

Notes

1. The summary of the regression results are given due to the space constraints.
2. All the models are in unconditional form.
3. The average statistics are used for the decision making.

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