MACROECONOMIC FACTORS AND EMERGING EQUITY MARKET: A CONTEXTUAL ANALYSIS USING QUANTILE REGRESSION

Mousumi Bhattacharya *, Sharad Nath Bhattacharya **

* *Corresponding author,* Indian Institute of Management (IIM) Shillong, Meghalaya, India
Contact details: Indian Institute of Management (IIM) Shillong, Umsawli, Shillong 793018, East Khasi Hills District, Meghalaya, India
** Indian Institute of Management (IIM) Shillong, Meghalaya, India

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Abstract

This article examines the role of macroeconomic factors in influencing Indian stock market movements across different market conditions. The study is important for market participants and policymakers as macroeconomic factors may be the source of systematic risk that influences the stock market. We employ factor analysis as a solution to the multicollinearity issues associated with multiple macroeconomic factors. Using three statistical factors built from macroeconomic factors, we show how they impact the stock market, particularly during up and down market conditions. While the influence of foreign exchange rate, broad money supply, economic growth, wholesale inflation, global equity markets, and export is positive and stable across market conditions, an inverse relationship between contemporaneous bond yield and equity market movements is evidenced. Gold and foreign institutional investment inflows seem to exert an increasingly negative influence on market movements at extreme up-market conditions. These findings call for active intervention by policymakers to stabilise the market during extreme market conditions.

Keywords: Macroeconomic Factors, Stock Market, Factor Analysis, Quantile Regression

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1. INTRODUCTION

The central idea behind the notion that macroeconomic (ME) factors affect stock market returns is intuitive. Fama (1970) noted that stock prices often represent the expectations of the company's future performance, which is, in turn, impacted by the ME setting in which it operates. Multi-factor asset pricing models are built on the premise that as long as the future investment opportunity set is affected by any factor, the factor is expected to be priced (Merton, 1973). The arbitrage pricing theory propounded by Ross (1976) showed that risk factors should earn risk premia in a risk-averse economy. The fundamental theory, however, did not define the range of factors. While the market risk factor is the most factor across asset pricing models, ME factors are worthy contenders for the extra market risk factors. While economic conditions influence the number and types of real investment opportunities available in a country, ME changes simultaneously affect several firms' cash flows and may influence the interest rate prevailing in the economy, which changes the risk-adjusted discount rate. In theory, the relationship between interest rates and stock prices is negative, as explained by the cash flow discounting model.

The economic theory suggests that interest rates, inflation, money supply, price level, and other macro elements are important variables in understanding the systematic risks that may influence stock prices. Further, an increase in interest rates invariably increases the opportunity cost of holding money, which drives the investors to substitute stocks and interest-bearing securities, leading to a decline in stock prices. Interest rates are also influenced by inflation, which is positively related to money growth rates, indicating a possible role of money supply affecting stock prices. Investors also adjust their portfolio holding during monetary shocks affecting stock prices.

The exchange rate, which reflects the movement of currency values, affects stock prices, similar to inflation. When the local currency weakens, importing is more expensive than exporting, resulting in higher production costs for importers. Because of market competition and rivalry, all costs cannot be passed on to consumers, resulting in lower company profits and stock prices. Bhattacharya and Dasa (2014) evidenced that not only forex rates but forex reserves are also important in explaining the stock market movement.

The stock markets often respond quickly to news about industrial production. Low industrial output translates to lower sales and earnings for businesses. Thus, poor industrial production data often leads to a plunge in stock prices (assuming the dividend discount model holds). An alternative to stock market investments is the commodity markets which have drawn investors' interest as a "safe haven", possibly due to a higher degree of certainty during turbulent times (Baur & McDermott, 2010). The two commonly traded commodities, oil, and gold have become common economic indicators. The price of oil and gold has a significant economic effect on financial activities (Ebrahim, Inderwildi, & King, 2014). Investment in gold often acts as a buffer against inflation, an important component in portfolio allocation, and has shown its importance in crises, as gold acts as a hedge to diversify its growing risk. Padungsaksawasdi (2020) and the references therein support the role of gold prices or gold investment in influencing stock markets. In most oil and gold importing countries like India, governments levy taxes to balance the impact of gold and crude oil imports on the exchange rate. These, in turn, have connections to the country's economy, as best reflected by the stock market index. Jain and Biswal (2016) noted the connectedness between Indian forex rates, oil, gold, and the equity market. Guhathakurta, Bhattacharya, and Bhattacharya (2020) showed the connectedness between financial markets. They argued that intermarket connectedness contributes to systemic risk indicating a role for world equity markets in influencing a particular stock market. Thus, the study would be incomplete if gold, oil, currency, and world market data are absent in the sample set.

While there exists voluminous literature on what ME variables impact stock returns, both at the firm level and market level, the sensitivity of ME factors with stock market returns during different market conditions is less researched, more so in an order-driven market. Emerging markets like India are mainly order-driven markets in contrast to quote-driven markets of the developed countries. It also provides an ambiance where the impact of political, regulatory, and economic forces is different from its developed peers. The research article aims to analyse the influence that the ME factors assert on the Indian stock market and identify the set of ME variables that correspond more closely with the stock market. Using thirteen ME variables, we conduct a factor analysis; and using the factors, we use quantile regression to understand how the factors impacted stock market returns across return distributions, especially at the distribution tails. Understanding the influence of ME variables at the extreme tails of the return distribution is important as the government and the central bank often resorts to active policy intervention at such times. The findings of this study can guide the policymakers on the choice of alternative macro variables available to them.

The remainder of the article is structured as follows. Section 2 discusses the relevant literature. In Section 3, we describe the data and empirical methodology. Section 4 presents the empirical results, and Section 5 concludes the article.

2. LITERATURE REVIEW

Multi-factor models were developed to capture the factors missing in the capital asset pricing model (CAPM) (Sharpe, 1964) and were motivated by the arbitrage pricing theory (APT) proposed by Ross (1976). The CAPM provides the first testable framework to understand how expected return and the systematic risk might be related. The APT is a theory of asset pricing that holds that asset returns can be forecasted with a set of macroeconomic factors that affect the asset risk. The initial studies on the APT focused on individual security returns. However, it can be used for a stock market where the systematic risk factor is proxied by a suitable ME variable. Chen, Roll, and Ross (1986) were amongst the first to test the associations between stock return and ME variables. The negative association between stock returns with inflation and money growth was studied by Fama (1981) and Geske and Roll (1983). A completely contrary viewpoint was established by Chan, Karceski, and Lakonishok (1998), who disregarded the effect of ME factors on stock returns. Naka, Mukherjee, and Tufte (1998) reported that domestic inflation strongly affects stock market performance in the Indian context, while Chancharat, Valadkhani, and Havie (2007) found that international market returns and oil prices influence stock returns in Thailand. Yartey (2008) examined forty-two emerging financial markets and found that certain factors like gross domestic product, income level, liquidity of the stock market, capital flows (private), financial sector development are significant in influencing the stock market development. Özlen and Ergun (2012) found that the interest rate and exchange rate significantly influence the Bosnia and Herzegovina equity markets. The interaction between the stock market and the exchange rate is often contradictory and inconclusive (Gavin, 1989; Murinde & Poshakwale, 2004; Phylaktis & Ravazzolo, 2005). Mohammad, Naqvi, Lal, and Zehra (2012) observed that Pakistan's domestic interest rate is negatively associated with the stock market return. Al-Majali and Al-Assaf (2014) document the influence of weighted average interest rates on time deposits, consumer price index (CPI), and credit to the private sector on Jordon's stock market. Alam and Uddin (2009) empirically validate the influence of interest rates on the stock market in developed and developing markets. In the presence of inflation, Eldomiaty, Saeed, Hammam, and AboulSoud (2020) noted a persistent relationship between US equity markets and interest rates. Focussing on the post-liberalisation period, Panda and Kamaiah (2001) explored the causal relations using a vector autoregression (VAR) approach. They found dynamic acquaintances among monetary policy, inflation, real activity, and stock returns. The role of gold investments in influencing stock markets is supported by Choudhry, Hassan, and Shabi (2015) and Padungsaksawasdi (2020). Ingalhalli, Poornima, and Reddy (2016) and Arfaoui and Ben Rejeb (2017) argue for the influence of gold, crude oil, and forex rates on equity markets. A good summary of the empirical work related to ME factors and the stock market is documented by Ho and Odhiambo (2018) and Pal and Garg (2019) and references therein. Guhathakurta et al. (2020) use network diagrams to show that stock markets are integrated, and hence world markets play some role in influencing each equity market, albeit by varying degrees.

In the Indian context, Pethe and Karnik (2000) used the cointegration technique on the monthly data from April 1992 to December 1997 to study the relationship between ME factors and the Indian stock market. They conclude that ME factors and stock market nexus are inconclusive and rule out a long-run stable relationship. Mukhopadhyay and Sarkar (2003) report that about fourteen ME factors explain variations in Indian stock returns. Bidirectional causality between foreign institutional investment (FII) flows and Indian equity market return was evidenced by Babu and Prabheesh (2008). Goudarzi and Ramanarayana (2011) observed that FII and SENSEX are cointegrated and a bidirectional causality existed between them, while Garg and Bodla (2011) noted that both stock market returns and volatility declined after FIIs were allowed market access in India. Mishra and Singh (2012) used a generalised additive model in the Indian stock market and found a significant influence of ME variables. Lairellakpam and Dash (2012) used the Granger causality test and VAR techniques to evidence the role of crude oil prices, rates of interest, exchange rates, and gold prices in influencing the volatility in the Indian stock market. Pal and Garg (2019) document a significant impact of ME surprises on stock returns using VAR analysis. Using the Bai-Perron test, Parab and Reddy (2020) documented the time-varying impact of ME variables on Indian equity returns. Singh and Padmakumari (2020) document the impact of inflation announcements in generating abnormal stock returns in select sectors and selected periods.

Most of the work exploring the impact of macro factors on stock markets uses ordinary least square regressions, causality tests, cointegration tests, and similar. While ordinary regression focuses on the mean of the variables, it does not include an understanding of causation. The causality tests show if one data series helps predict or cause another while cointegration helps understand the long-run equilibrium relationships between the dependent and independent variables (McMillan, 2001). However, we argue that these methods fail to capture the asymmetric effects that the exploratory variables may have on returns at the left and right tails of the return distribution and is an area of interest in the study.

In this article, we augment the literature in the Indian context by constructing statistical factors from ME factors and using the statistical factors to understand their influence on the stock market using quantile regression. The use of quantile regression enables us to identify if the influence of factors, both in terms of magnitude and sign, changes with market conditions.

3. DATA AND METHODOLOGY

Macroeconomic data from April 2012 to June 2019 are obtained from Reserve Bank of India publications, Morgan Stanley Capital International (MSCI) publications, and Bloomberg. Chen et al. (1986) noted that the choice of appropriate ME factor necessitates subjective decision from the researcher. Based on established theory and empirical evidence (Chen et al., 1986; Srivastava 2010; Bhattacharya & Dasa, 2014; Pal & Garg, 2019), thirteen ME variables were initially selected that were expected to affect stock returns. The variables are explained below:

1. *Crude oil price (LCRUDE)*: The spot price of Brent is used as a measure of crude oil price. India is one of the leading oil-importing nations, and fluctuations in oil price impact the profitability of companies across industries as the cost of an increase in the oil price are passed on to the ultimate customers after a time gap and are generally not instantaneous in India.
2. *Gold price (LGOLD)*: The gold price is used to understand the impact of gold on equity. Indian investors prefer gold both as a consumption asset and as an important savings instrument expected to give diversification benefits and hedge against inflation.
3. *Call money rate (CALLRATE)*: Fleming, Kirby, and Ostdiek (1998) noted the informational role of call money rates that stems from cross-market hedging, which is expected to influence stock market movement.
4. *Real effective exchange rate (REER)*: This reflects the real value of the Indian currency (INR) against its principal trade partners. Variations in *REER* can impact the net foreign monetary and real domestic assets of firms. It also affects aggregate demand and the cost of traded inputs that, in turn, affect the profitability of firms and affect its equity price.
5. *Export (LEXP)*: India is one of the largest exporters of services, especially in technology and information technology-enabled services and others. An export shock is thus expected to affect the stock market.

6. *Forex reserves (LFOREX)*: Foreign exchange reserves act as a protection shield for a country facing economic shocks. To achieve the objective of financial stability, developing economies have been following the policy of forex reserve accumulation. As this reserve is often used to stabilise domestic currency value, it is expected to influence the equity market.

7. *Ten-year government bond (GOVTBOND10YR):* This is included as a proxy for the long-term rates in the Indian context. The long-term interest rate affects the discount rate, which, in turn, affects the cost of equity and, thus, equity valuation.

8. *Index of industrial production (IIP):* The logarithmic value of the index of industrial production is used as a proxy for economic growth. Industrial production is a picture of economic activity in the economy. Low industrial production figures indicate low sales and firm profitability and thus low expected future cash flows.

9. *Broad money supply (M3)*: The financial development of the economy is affected by monetary policy. The monetary policy reflects the money supply in an economy. Laopodis (2013) notes that an increase in the money supply leads to an increase in stock prices, which stimulates the stock market and the economy.

10. *Wholesale price index (WPI):* It is used to capture the consequence of inflationary pressure on stock prices. DeFina (1991) noted that an increase in inflation adversely affects firms' profitability as the firms are generally slow in revising the output prices. In contrast, the cost of input prices increases almost instantaneously, which, in turn, affects the share prices.

11. *Net foreign institutional investment (NETFII)*: Foreign investment inflows influence the stock market through enhanced information and capital flow, better transparency in the market, and improved valuations, along with a reduction in financing cost through base-broadening and risk pooling.

12. *World index (LWORLD)*: In this age of integration of financial markets, the Indian stock market is expected to be influenced by the global markets.

13. *Treasury bill (TB)*: Fama and French (1989) and Campbell and Thompson (2008) noted a significant correlation between the US Treasury yield and the US stock returns, while Bhattacharya and Dasa (2014) show the predictive power of treasury bills in explaining stock market movements in Indian equity markets. Ninety-one days Treasury bill yield is considered in the study.

We consider two stock market indices — Nifty 50 (*LNIFTY50*) and BSE SENSEX (*LBSESENSEX*), as a proxy for the stock market. The logarithmic value of the two indices is taken. An initial correlation analysis is done and is followed by the multicollinearity test. The variance inflation factors (VIF) for the variables being above 5 (see Table 2 below), we proceed with factor analysis.

Identifying factors is significant in the financial market-related research as factors represent the risks that affect the equity prices. Identification and segregation of factors by detecting common variations in the stock returns are done by factor analysis. Kritzman (1993) notes that although factors obtained using factor analysis can capture the sample variation in returns, a factor can have a combination of multiple (and often offsetting) influences. As a result, researchers have a difficult time interpreting factors.

We follow the Kaiser-Meyer-Olkin (KMO) procedure to check whether the data is suitable for factor analysis. The KMO statistic compares the magnitudes of the observed correlation coefficients with the magnitudes of the partial correlation coefficients. Kaiser (1974) documents that the KMO statistic should be at least 0.5 to proceed with factor analysis. The KMO statistic obtained here is 0.7896, and we obtain the factors using principal components analysis.

We run quantile regression (QR) equations with the obtained factor scores, as proposed by Koenker and Bassett (1978). It helps us evaluate the effect of explanatory variables on the dependent variable at different points of the dependent variable's conditional distribution. QR is robust compared to traditional regression methods as it does not necessitate the assumption of normality of the regression residuals and is robust to outliers. QR is expected to reveal a more accurate dependence structure between variables according to market conditions such as bull or bear markets. The τ-th conditional QR is expressed as the following equation:

$$Q_{Y_i}(\tau/X_k) = \sum_X \beta_k(\tau) X_k = X'\beta(\tau) \qquad (1)$$

where, $\beta(\tau)$ is the vector of coefficients associated with the τ-th quantile, and values for τ vary between 0 and 1.

Y_i is the dependent variable (i = LNIFTY50, LBSESENSEX), and the explanatory variables are the three-factor scores obtained from factor analysis.

We estimate QR coefficient $\beta(\tau)$ by:

$$\hat{\beta}_n(\tau) = argmin_{\beta(\tau)}\left[\sum \rho_\tau\big(Y_i - X'\beta(\tau)\big)\right]$$

where, $\rho_\tau(u) = u\big(\tau - 1(u < 0)\big)$ is the check function as detailed in Koenker and Hallock (2001).

4. DATA ANALYSIS AND FINDINGS

4.1. Descriptive statistics

Table 1 below represents the descriptive statistics of all the thirteen variables. The descriptive statistics reveal the four moments, the median, Jarque-Bera's statistic, and the range. All the thirteen variables are leptokurtic, as revealed by their positive kurtosis. The skewness for *LCRUDE, LFOREX, LGOLD, LWORLD, GOVTBOND10YR, REER, LNIFTY50, LBSESENSEX* is negative, suggesting left tailed distribution, while skewness for other ME factors is positive. However, Jarque-Bera's statistic shows that except for *LFOREX*, *CALLRATE*, and *TB*, the remaining variables may be normally distributed.

Table 1. Descriptive statistics

Variables	*Mean*	*Median*	*Maximum*	*Minimum*	*Std. Dev.*	*Skewness*	*Kurtosis*	*Jarque-Bera*
LCRUDE	4.23	4.19	4.78	3.42	0.36	-0.10	1.85	4.88 (0.09)
LFOREX	14.60	14.65	14.90	14.25	0.20	-0.28	1.74	6.92 (0.03)
LGOLD	11.32	11.32	11.46	11.17	0.07	-0.08	2.08	3.13 (0.21)
IIP	116.37	115.9	144.10	98.30	10.61	0.30	2.35	2.85 (0.23)
M3	112.6	112.25	154.31	75.32	22.79	0.084	1.91	4.35 (0.11)
WPI	113.04	112.9	122.0	104.7	4.37	0.27	2.31	2.81 (0.24)
LWORLD	7.45	7.44	7.70	7.07	0.15	-0.39	2.58	2.83 (0.24)
GOVTBOND10YR	7.78	7.80	8.93	6.30	0.63	-0.13	2.46	1.31 (0.51)
CALLRATE	6.76	6.46	9.97	3.56	1.09	0.34	4.09	5.97 (0.05)
REER	113.6	114.43	124.17	101.25	5.51	-0.22	2.38	2.11 (0.34)
LEXP	7.36	7.34	7.72	7.11	0.13	0.41	2.61	3.04 (0.21)
TB	7.33	7.10	11.14	5.69	1.12	0.83	3.72	12.090 (0.00)
NETFII	5277.6	5980	40576.39	-25774	11353.1	0.18	3.55	1.57 (0.45)
LNIFTY50	8.99	9.02	9.38	8.50	0.24	-0.26	1.96	4.86 (0.08)
LBSESENSEX	10.18	10.20	10.58	9.69	0.24	-0.22	2.04	4.05 (0.13)

Note: (.) represents p-values.

4.2. Correlation analysis

The correlation between the thirteen ME factors and *LNIFTY50* and *LBSESENSEX* and the result of the multicollinearity test are presented below in Table 2. The correlation analysis shows a significant and high correlation between stock market returns and macroeconomic variables, except *LGOLD*, which shows low significant correlation lending support to the idea that gold acts as a "safe heaven". A significant negative relationship exists between the stock market returns and crude oil, call rates, net foreign institutional investments, 10-year government bond rates, and treasury bill rates. The variance inflation factor (VIF) values for most of the variables are above 5, suggesting that the ordinary least square (OLS) regression may result in misleading results due to multicollinearity issues. We employ factor analysis that cuts the number of predictors to a smaller set of uncorrelated components to address the multicollinearity issue.

Table 2. Correlation coefficient and VIF values

Independent variable	*LNIFTY50*	*LBSESENSEX*	*VIF*
LCRUDE	-0.5376	-0.5616	19.8102
LFOREX	0.9366	0.9423	106.061
LGOLD	0.0615	0.0675	3.500
IIP	0.8582	0.8618	13.600
M3	0.9514	0.9539	130.148
WPI	0.7882	0.7648	25.640
LWORLD	0.9532	0.9486	31.372
GOVTBOND10YR	-0.5561	-0.5889	5.358
CALLRATE	-0.2378	-0.2691	5.421
REER	0.7914	0.8184	10.860
LEXP	0.6606	0.6400	9.387
TB	-0.7188	-0.7476	8.765
NETFII	-0.1390	-0.1444	2.091

4.3. Factor analysis

We determined the sampling adequacy of data for factor analysis using KMO statistic. While a KMO statistic value closer to 1 is recommended and any value greater than 0.60 is considered acceptable by the research community to conduct factor analysis, the obtained KMO statistic value of 0.789 in Table 3 supports the sample adequacy to conduct the factor analysis. The KMO statistic of 0.789 indicates that the proportion of variance in the ME factors caused by the underlying statistical factors is quite high.

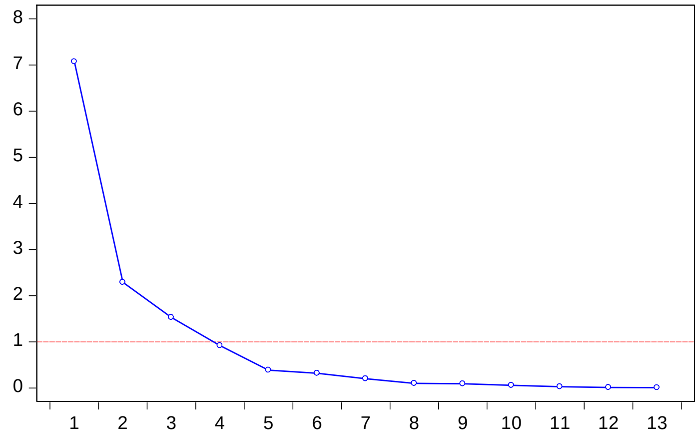
Table 3. Kaiser-Meyer-Olkin (KMO) statistic

Independent variable	*Kaiser's measure of sampling adequacy (MSA)*
LCRUDE	0.634924
LFOREX	0.800562
LGOLD	0.389063
IIP	0.882470
M3	0.832893
WPI	0.759880
LWORLD	0.791592
GOVTBOND10YR	0.843727
CALLRATE	0.607197
REER	0.863711
LEXP	0.813450
TB	0.948252
NETFII	0.287226
Kaiser's MSA	0.789**

*Notes: ** represents significance at 95% level.*

Next, we need to find the number of factors for the factor analysis or principal component analysis. A scree plot summarises decreasing variability attributable to each successive factor and uses eigenvalues to measure the proportion of variance explained by each factor. A low eigenvalue indicates a low contribution from the respective factor in explaining the variances in the variables and may be ignored as redundant. In Figure 1, the line flattens almost from the fourth factor, suggesting that each successive factor accounts for lesser and lesser amounts of the total variance. However, after the third factor, the remaining factors have eigenvalues less than one, suggesting that the remaining factors account for a very small proportion of the variability and are likely unimportant.

Figure 1. Principal component analysis scree plot



The plot above suggests that most of the variance is contained in the first three eigenvalues. Thus, we consider only three factors (F1, F2, and F3) to capture most of the variability in the data. The rotated component matrix is shown below in Table 4.

Table 4. Rotated component matrix

Independent variable	*F1*	*F2*	*F3*
LCRUDE	-0.038963	0.920154	0.284074
LFOREX	0.719308	-0.680467	-0.130408
LGOLD	0.198409	-0.044812	0.573335
IIP	0.719211	-0.560746	0.102081
M3	0.788685	-0.613587	0.038563
WPI	0.976327	0.023368	0.053364
LWORLD	0.865308	-0.378682	-0.091396
GOVTBOND10YR	-0.143249	0.814092	-0.222283
CALLRATE	0.008866	0.550674	-0.358448
REER	0.389997	-0.758381	0.069055
LEXP	0.863288	0.010544	0.149301
TB	-0.365241	0.804213	-0.200154
NETFII	-0.110619	0.191262	0.446015

Notes: Extraction method: Principal component analysis (PCA). Rotation method: Orthogonal Varimax.

The rotated component matrix shows loadings on the statistical factors after rotation. *LFOREX, M3, IIP, WPI, LWORLD, LEXP* load heavily on principal component 1 or statistical factor 1 (F1). *LCRUDE, GOVYBOND10YR, CALL RATE, REER, TB* loads on statistical factor 2 (F2). *LFOREX* seems to have an offsetting effect on F2, while *NETFII, LGOLD* loads on statistical factor 3 (F3). With the factor scores as explanatory variables, we employ QR analysis on *LNIFTY50* and *LBSESENSEX.*

4.4. Quantile regression

Quantile regression (QR) allows us to explore various aspects of the relationship between the dependent variable and the independent variables without any restrictive assumptions about the distribution of the residuals. Table 5 shows the statistical factors obtained through principal component analysis on the Indian equity market across nine quantiles. The intercept is insignificant across quantiles for both *NIFTY50* and *BSESENSEX.* The coefficient of F1 is positive and significant in all the quantiles, while the coefficient of F2 is negative and significant across all quantiles. The highest value of the coefficient of F2 is at $\tau = 0.6$ for both *NIFTY50* and *BSESENSEX.* The coefficient of F3 is insignificant at and below the median but significant from $\tau = 0.6$. However, it is negative, significant, and monotonically decreasing for both *NIFTY50* and *BSESENSEX.* Thus, QR highlights the asymmetric influence of factors one and three in different market conditions. The Pseudo R-squared is a goodness-of-fit statistic for QR and is quite satisfactory. It is equivalent to the R-squared from conventional regression analysis and is obtained as per Koenker and Machado (1999).

Table 5. Quantile regression coefficient estimates

Dependent variable	*τ*	*Intercept*	*Coefficient of F1*	*Coefficient of F2*	*Coefficient of F3*	*Pseudo R-squared*
LNIFTY50	0.1	8.92	0.187***	-0.145***	0.013	0.753
	0.2	8.94	0.192***	-0.142***	0.007	0.768
	0.3	8.95	0.192***	-0.142***	-0.002	0.769
	0.4	8.97	0.188***	-0.137***	-0.008	0.745
	0.5	8.99	0.187***	-0.128***	-0.012	0.729
	0.6	9.01	0.191***	-0.109***	-0.021***	0.722
	0.7	9.03	0.189***	-0.121***	-0.023***	0.723
	0.8	9.05	0.178***	-0.130***	-0.035***	0.704
	0.9	9.07	0.169***	-0.129***	-0.037***	0.669
LBSESENSEX	0.1	10.114	0.188***	-0.137***	0.015**	0.768
	0.2	10.131	0.196***	-0.131***	0.005	0.779
	0.3	10.143	0.196***	-0.13***	0.001	0.777
	0.4	10.169	0.193***	-0.129***	-0.009	0.751
	0.5	10.18	0.190***	-0.123***	-0.007	0.736
	0.6	10.201	0.194***	-0.107***	-0.02***	0.728
	0.7	10.224	0.192***	-0.112***	-0.025***	0.734
	0.8	10.234	0.189***	-0.114***	-0.03***	0.718
	0.9	10.268	0.173***	-0.116***	-0.04***	0.667

*Notes: ***, ** represent significance at 99% and 95%, respectively.*

We plot the behaviour of all the coefficients along with their confidence intervals across the quantiles in Figure 2 and Figure 3. The nonlinearity in the plots justifies the use of QR over ordinary least square regression. The distinct kink at 0.6 quantiles for the coefficient of F2 is visible in the figure for both indices.

Figure 2. Quantile regression coefficient estimates (*LNIFTY50*)

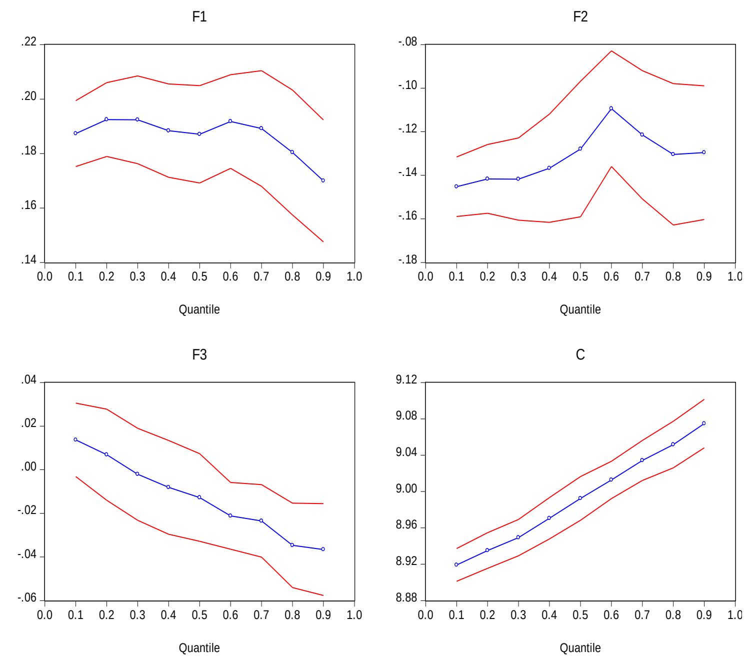
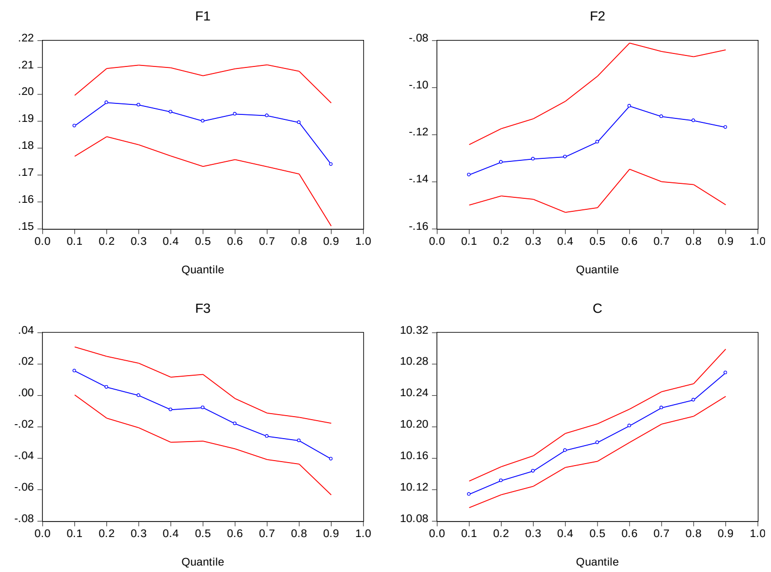


Figure 3. Quantile regression coefficient estimates (*LBSESENSEX*)



Following Bassett and Koenker (1982), we test for the equality of slopes across quantiles as a robust test of heteroskedasticity. The acceptance and rejection of the null hypothesis of equality of slopes across quantiles are made using Wald statistic, which follows the Chi-squared distribution. For the QR with *LNIFTY50* as the dependent variable, the Wald statistic value is 8.93 with 6 degrees of freedom, while for the QR with *LBSESENSEX*, as the dependent variable, the Wald statistic value is 11.96 with 6 degrees of freedom. Both are insignificant at an acceptable level of significance, indicating that the coefficients do not differ across quantile values. The findings are in support of homoscedasticity.

5. CONCLUSION

The findings suggest that cross-sectional variation in return can be explained by three statistical factors, which are formed linear combinations of several ME factors. Foreign exchange (USD-INR) rate, broad money supply, economic growth, wholesale inflation, global equity markets, and export load positively on F1. While bond market variables, crude oil, and forex reserve are loaded on F2, gold and FII inflow are represented in F3. The coefficient of F1 is consistently positive and significant across all quantiles suggesting that the impact of the foreign exchange rate, broad money supply, economic growth, wholesale inflation, global equity markets, and export is stable across market conditions. This is similar to observations of Mukhopadhyay and Sarkar (2003), Chancharat et al. (2007), Özlen and Ergun (2012), and Naik and Padhi (2012). However, their studies do not distinguish market conditions while we observe that the impact decreases at higher quantiles or during an extremely bullish market. The negative coefficient of F2 across quantiles indicates an inverse relationship between contemporaneous bond yield and equity market movements. This is as per expectation as a higher yield increases the discount rate reducing the valuation of equity. The inverse relationship indicates the rising cost of loans leading to lower levels of firm profitability, which stimulates investors to exit their holdings and lowers the contemporaneous price. Büyükşalvarcı (2010), Mohammad et al. (2012), Al-Majali and Al-Assaf (2014) noted that the ME factors like interest rates negatively influence stock return. Our findings support Chancharat et al. (2007) in that oil prices and stock markets are inversely related. The net foreign investment inflows and gold do not significantly impact stock market movement during down markets but assert a significant negative influence after the median. The coefficient of F3 shows an increasingly negative influence at higher quantiles. Possibly when market valuations are high, the FIIs realise profit while Indian investors generally shift their investment from gold to the stock market, leading to the inverse relationship between them. The findings are consistent across both indices. The asymmetric influence of gold and FIIs on stock market conditions calls for further policy interventions and analysis in the Indian equity market. Overall, the findings support a nonlinear relationship between ME variables and the stock market, similar to Gopinathan and Durai (2019).

A limitation of the present study is the exclusion of tax-related data and the market micro structure-related data in the analysis. It would be interesting to see how the inclusion of these data impacts the result in future research.

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