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A Study on the Effect of Macroeconomic Variables on Indian Mutual Funds

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Abstract

Indian financial markets have witnessed very high levels of volatility in recent months, with a sharp decline in the BSE-SENSEX from a peak of around 21,000 points to a nadir below 11,000 points, with as much as a 700-point fall on one single day. Indian economic conditions have also seemed to stagnate, with an overall slow-down in economic growth, along with the pressures of increasing crude oil prices and increasing inflation. In fact, the overall global scenario has also been quite bleak, especially with the onset of recession in the US. Mutual fund investments, which are generally considered to be less risky than other financial instruments such as shares and debentures, have also suffered in the general atmosphere of volatility.

The present study investigates the effect of macroeconomic variables on mutual fund schemes, in terms of returns and volatility. The study uses the Granger causality test to analyze these effects. The results of these causality tests would identify the specific macroeconomic factors which affect the returns and volatility of particular mutual fund schemes, which, on the one hand, would enable fund managers to manage the risk profiles of their portfolios more effectively; and, on the other hand, would enable investors to understand the specific risk factors affecting their investments, so that they can take more informed investment decisions pertaining to mutual funds.

The data to be used in the study were the weekly returns and volatilities of different macroeconomic variables, such as market returns (calculated from the BSE-SENSEX), USD/INR and EURO/INR exchange rates, interest rates (Mumbai Inter-Bank Offer rates), inflation rates, and crude oil prices, over the period October '06 - June '08. The weekly returns and volatilities of a sample of major mutual fund schemes over the same period would be considered for the analysis.

Keywords: returns, volatility, macroeconomic variables, mutual fund schemes, Granger causality.

Introduction

The Capital Asset Pricing Model (CAPM; Sharpe, 1964; Treynor, 1961; Lintner, 1965) is used to determine a theoretically appropriate required rate of return (and thus the price if expected cash flows can be estimated) of an asset, given the asset's systematic risk. To do so, the CAPM takes into account the asset's systematic risk, the expected return of the market, and the risk-free rate of return.

The CAPM decomposes an asset's risk into systematic and specific risk. The systematic risk of an asset is that component of the total risk of the asset that is explained by market risk. This is captured through the regression of asset returns r_t on market returns r_{Mt}, viz.

$$(1) \quad r_t = \alpha + \beta . r_{Mt} + \varepsilon_t .$$

Specific risk, or unsystematic risk, is the risk which is unique to an individual asset. It represents the component of an asset's return which is uncorrelated with general market moves. According to CAPM, the marketplace compensates investors for taking systematic risk, but not for taking specific risk. This is because specific risk can be diversified away. When an investor holds a portfolio, each individual asset in that portfolio entails specific risk, but through diversification, the investor's net exposure is just the systematic risk of the portfolio.

According to the CAPM, the expected return of a portfolio equals the risk-free rate plus the portfolio's beta multiplied by the expected excess return of the market portfolio, i.e.

$$(2) \quad E(r) = r_f + [E(r_M) - r_f].\beta(r) .$$

The security market line, as equation (2) is also called, is the essential conclusion of CAPM. It states that a portfolio's excess expected return over the risk-free rate depends on its beta and not on its volatility; that is, a portfolio's excess return depends upon its systematic risk and not on its total risk.

The CAPM is an "asset pricing model" because, given a beta and an expected return for an asset, investors will bid its current price up or down, adjusting the expected return so that it satisfies equation (2). Once the expected return is calculated using CAPM, the future cash flows of the asset can be discounted to their present value using this rate to establish the correct price for the asset. In theory, therefore, an asset is correctly priced when its observed price is the same as its value calculated using the CAPM derived discount rate. If the observed price is higher than the valuation, then the asset is overvalued (and undervalued when the observed price is below the CAPM valuation). Alternatively, one can "solve for the discount rate" for the observed price given a particular valuation model and compare that discount rate with the CAPM rate. If the discount rate in the model is lower than the CAPM rate then the asset is overvalued (and undervalued for a too high discount rate). Accordingly, the CAPM predicts the equilibrium price of an asset, assuming that all investors agree on the beta and expected return of any asset. In practice, this assumption is unreasonable, so the

CAPM is largely of theoretical value.

The CAPM has several limitations. Firstly, it assumes that asset returns are (jointly) normally distributed random variables. However, it is frequently empirically observed that returns in equity and other markets are not normally distributed; i.e. large swings (often more than three or six standard deviations from the mean) occur in the market more frequently than the normal distribution assumption would expect. It also assumes that the variance of returns is an adequate measurement of risk. This might be justified under the assumption of normally distributed returns, but for general return distributions other risk measures will likely reflect the investors' preferences more adequately. Also, in practice, the CAPM does not appear to adequately explain the variation in stock returns. Empirical studies show that low beta stocks may offer higher returns than the model would predict.

Since beta reflects sensitivity to market risk, the market as a whole, by definition, has a beta of one. Stock market indices are frequently used as local proxies for the market - and in that case (by definition) have a beta of one. An investor in a large, diversified portfolio (such as a mutual fund) therefore expects performance in line with the market. The market portfolio should in theory include all types of assets that are held by anyone as an investment (including works of art, real estate, human capital...), but, in practice, such a market portfolio is unobservable and people usually substitute a stock index as a proxy for the true market portfolio. Unfortunately, it has been shown that this substitution is not innocuous and can lead to false inferences as to the validity of the CAPM, and it has been said that due to the unobservability of the true market portfolio, the CAPM might not be empirically testable.

Arbitrage Pricing Theory (APT; Ross, 1976) is a general theory of asset pricing that generalizes the CAPM. APT holds that the expected return of a financial asset can be modeled as a linear function of various macro-economic factors or theoretical market indices, where sensitivity to changes in each factor is represented by a factor-specific beta coefficient.

Similarly to the CAPM, the APT decomposes a portfolio's risk into systematic and specific risk. This is captured through the regression of portfolio returns r_t on a set of risk factors $F_1, \dots F_k$, viz.

$$\text{(1a)}\ r_t = \alpha + \beta_1.F_{1t} + \dots + \beta_k.F_{kt} + \varepsilon_t .$$

The regression (1a), known as the first-pass regression, identifies the portfolio's factor sensitivities $\beta_1, \dots \beta_k$, which, similarly to the CAPM's $\beta(r)$, measure the sensitivity of the portfolio returns to changes in the risk factors. According to APT, the expected return of a portfolio is linearly related to its factor sensitivities, i.e.

$$\text{(2a)}\ E(r) = \lambda_0 + \lambda_1.\beta_1(r) + \dots + \lambda_k \beta_k(r) ,$$

where the $\lambda_1, \dots \lambda_k$ represent risk premia corresponding to each of the risk factors $F_1, \dots F_k$. The model in equation (2a) is estimated by regression of portfolio returns on the factor sensitivities, yielding estimates for the risk premia.

The APT asserts that equation (2a) can be used to find the expected return of a portfolio given its factor sensitivities. The model-derived rate of return will then be used to price the asset correctly - the asset price should equal the expected end of period price discounted at the rate implied by model. If the price diverges, arbitrage should bring it back into line.

The APT describes the mechanism whereby arbitrage by investors will bring an asset which is mispriced, according to the APT model, back into line with its expected price. Note that under true arbitrage, the investor locks-in a guaranteed payoff, whereas under APT arbitrage as described below, the investor locks-in a positive expected payoff. The APT thus assumes "arbitrage in expectations" - i.e. that arbitrage by investors will bring asset prices back into line with the returns expected by the model portfolio theory. In the APT context, arbitrage consists of trading in two assets, with at least one being mispriced. The arbitrageur either sells the asset which is relatively overpriced and uses the proceeds to buy one which is correctly priced, or sells an asset that is correctly priced and uses the proceeds to buy the asset that is relatively underpriced. A correctly priced asset in this context may be in fact a synthetic asset - a portfolio consisting of other correctly priced assets - which has the same exposure to each of the macroeconomic factors as the mispriced asset. When the investor is long the asset and short the portfolio (or vice versa), he has created a position which has a positive expected return (the difference between asset return and portfolio return) and which has a net-zero exposure to any macroeconomic factor and is therefore risk free (other than for firm specific risk). The arbitrageur is thus in a position to make a risk-free profit.

The APT differs from the CAPM in that it is less restrictive in its assumptions. It allows for an explanatory (as opposed to statistical) model of asset returns. In some ways, the CAPM can be considered a "special case" of the APT in that the securities market line represents a single-factor model of the asset price, where beta is exposed to changes in value of the market. The APT can be seen as a "supply side" model, since its beta coefficients reflect the sensitivity of the underlying asset to economic factors. Thus, factor shocks would cause structural changes in the asset's expected return, or in the case of stocks, in the firm's profitability. On the other hand, the CAPM is considered a "demand side" model. Its results, although similar to those in the APT, arise from a maximization problem of each investor's utility function, and from the resulting market equilibrium (investors are considered to be the "consumers" of the assets).

As with the CAPM, the factor-specific betas are found via a linear regression of historical security returns on the factor in question. Unlike the CAPM, the APT, however, does not itself reveal the identity of its priced factors - the number and nature of these factors is likely to change over time and between economies. As a result, this issue is essentially empirical in nature. Chen, Roll and Ross (1986) identified the following macro-economic factors as significant in explaining security returns: surprises in inflation; surprises in GDP as indicted by an industrial production index; and surprises in investor confidence due to changes in default premium in corporate bonds. In practice, indices or spot or futures market prices may be used in place of macro-economic factors, which are reported at low frequency (e.g. monthly) and often with significant estimation errors. Market indices are sometimes derived by means of factor analysis. More direct "indices" that might be used are: short term interest rates; the difference in long-term and short term interest rates; a diversified stock index; oil prices; gold or other precious metal prices; currency/exchange rates, and other macroeconomic variables.

Literature Review

There is abundant empirical evidence indicating that the source of risk introduced in CAPM does not explain the cross-sectional expected returns, such as Fama and French (1995, 1996), suggesting that one or more additional factors may be required to characterize the behavior of expected returns. A number of studies have examined the impact of firm-specific variables such as firm size and book-to-market-value, as in Fama and French (1992), while other studies have examined the impact of the macro-economic factors, as in Chen, Roll and Ross (1986), Antoniou, Garret and Priestly (1998), and Poon and Taylor (1992).

A major issue in the empirical analysis of any asset pricing model, apart from the question of whether it adequately prices the assets, is that it must be robust enough whilst simultaneously offering economic insight into the determinants of security returns. Fama (1991) argued that a model requires more evidence on how different factors explain pricing assets in different samples. And therefore, to determine the economic factors, influencing pricing is not sufficient to assess the empirical content of APT. The validity of APT also depends on its ability to price assets outside of the sample used for estimation. Fama (1991) argued that the relations between returns and economic factors may be spurious requiring for a robustness check outside the sample studied. Connor and Korajczyk (1992) argued that a testable implication of the APT is the equality of the prices of risk across different sub-samples of assets. Antoniou, Garrett and Priestley (1998) examined the uniqueness of the returns generating process for two sub-samples of assets. Using the estimation method that allows idiosyncratic returns to be correlated across assets, they found that three factors are unique in the sense that they carry the same prices of risk in both samples.

Malkamäki (1990) examined the CAPM using time-varying-parameter models. Prior evidence does not support the CAPM in that it suggests that market risk is not priced or that the price of the beta risk is significantly negative for a thin European stock market, e.g. the Finnish stock market. Malkamäki showed explicitly that this phenomenon is due to static ordinary least squares beta estimates which are spurious, and reduced the errors-in-variables problem by estimating firm-specific betas using Kalman filter techniques and employed the betas forecasted on the basis of these estimated betas in a cross-sectional analysis. Analysis of pooled data showed that the price of conditional risk is positive and that the mean-variance efficiency of the market index cannot be rejected, supporting the CAPM.

Soufian (2001) investigated the validity of CAPM and APT for securities traded on the London Stock Exchange, in order to explain pricing across time, taking three different sub-samples of time periods on the basis that during each subset of samples the UK economy experienced different economic conditions (1980-1997). Soufian applied the two-stage procedure analysis of Fama and McBeth (1973) to test the proposition that at any point in time there is a linear and positive relationship between CAPM's β coefficient and expected returns.

Soufian used time series techniques for the pre-whitening process. Before testing the relationship between stock returns and macro-economic series, it is essential to identify the process that generating the series. If an input series is auto-correlated, the direct cross-correlation function between the input and response series gives a misleading indication of the relation between the input and response series. Since the estimated risk premia in asset pricing are sensitive to the way that the unexpected components are generated to test the APT and CAPM, it is essential to use an appropriate method to generate the unanticipated factors. Statistically, it is possible to obtain the time series of unexpected movements by identifying and estimating a vector auto-regressive model in an attempt to use its residuals as the unexpected innovations in the economic factor. Soufian performed the pre-whitening process for the input series; market portfolios and the macroeconomic series, by firstly fitting a univariate ARIMA model to each series sufficient to reduce the residuals to white noise, and then secondly filtering the input series with this model to get the white noise residual series.

Davidson (2002) argued that, to the extent that asset pricing models are employed by investors and corporations for decision making purposes, the CAPM is the most likely candidate. As Fama and French (1997) asserted, "the choice of model is important." Davidson examined whether the CAPM-β is a good proxy for the "true" factors that drive returns, following the work of Born and Moser (1988) and Wei (1988). Born and Moser (1988) calculated factor loadings on six factors (using principal component analysis) for the thirty stocks that comprise the Dow Jones Industrial Index in the period 1962-1982, and regressed the factor loadings against the corresponding β's. They found evidence that β is a "consensus" risk factor: at the five percent significance level they report that three factors are priced, and at the ten percent level an additional factor is priced (Born and Moser, 1988). Davidson followed a similar methodology, using an endogenous APT model where the factors are extracted from the returns data using factor analysis, and found evidence that the international CAPM beta is a consensus measure of up to four return generating factors.

Dash (2017) analysed Granger causality in the context of the CAPM for NSE stocks. He found that there was significant bi-directional causality between stock returns and market returns for 93.33% of the sample stocks considered in their study, while there was no significant causality of stock returns with market returns in either direction for 6.67% of the sample stocks considered, indicating that though market returns is a necessary factor in explaining individual stock returns, it in itself it does not explain stock returns.

Thus, though several studies address the empirical testing of the CAPM and the APT, very few use time series techniques. As Soufian (2001) has pointed out, in order for the regression analyses used for CAPM and APT tests to be meaningful, it is essential to identify the processes that generate the series. In particular, Granger causality on security returns has not been analyzed in the literature.

The present study examines Granger causality in the context of the APT for Indian stocks.

The validity of the APT in particular would imply that there should be some form of causality from changes in market returns to changes in security returns. The macroeconomic variables used in the study include market returns (calculated from the BSE-SENSEX), USD/INR and EURO/INR exchange rates, interest rates (Mumbai Inter-Bank Offer rates), inflation rates, and crude oil prices.

Data & Methodology

The present study investigates Granger causality between the daily returns and volatility of Indian mutual fund schemes and different macroeconomic variables. The data for the study consisted of the weekly averages and variances of NAV returns of a sample of seventeen mutual fund schemes, and the weekly averages and variances of the macroeconomic variables over the period of ninety-one weeks, from Oct. 2006 through to June 2008. The sample mutual fund schemes were selected by convenience sampling from three mutual fund houses: Canara Bank Mutual Fund, Franklin Templeton Mutual Fund, and Reliance Mutual Fund. The data was collected from different official websites. Wherever applicable, daily closing values were collected, and the weekly averages and variances were computed using values corresponding to Tuesday, Wednesday, and Thursday only, in order to avoid any beginning-of-the-week or end-of-the-week effects. The weekly returns were computed as a "percentage difference" based on the weekly averages, from which first order forward differences and lags were computed, as desired below. The optimal lag structure used for the computation in the study consisted of ten-week lagged first order differences of each variable.

The objective of the study was to investigate causality between the daily returns and volatility of mutual fund schemes and different macroeconomic variables. For this purpose, following Granger (1969), the following modified linear Granger causality tests were employed. In order to assess the effect of the macroeconomic variable j_0 on the NAV returns/variance of the mutual fund scheme, the Granger causality tests involve the estimation of the following models:

(a) the unrestricted model:

$$\Delta y_t^{\ 0} = a + \sum_{i=1}^{p_0} b_i^0 \Delta y_{t-1}^0 + \sum_{j=1}^{k} \ \sum_{i=0}^{p_j} b_i^j \Delta y_{t-i}^j + \varepsilon_{1t} ,$$

where Δy_t^0 are the first order forward differences in the weekly NAV returns/variance of returns of the mutual fund scheme, and Δy_t^j are the first order forward differences in the weekly average values/variances of the explanatory macroeconomic variables.

(b) the restricted model:

$$\Delta y_t^0 = a + \sum_{i=1}^{p_0} b_i^0 \Delta y_{t-i}^0 + \sum_{j \neq j0} \ \sum_{i-1}^{p_j} b_i^j \Delta y_{t-1}^j + \varepsilon_{2t}$$

(i.e. excluding the particular macroeconomic variable j_0).

The coefficients a, b_i^0, and b_i^j are the parameters to be estimated in the regressions, and the orders p_0 and p_j are the optimal lags chosen by Akaike's (1969) information criterion. In order to test the significance of the effect of the macroeconomic variable j_0 on the NAV returns of the mutual fund scheme, the usual F-statistic as below is employed:

$$F = \frac{(SSE_R - SSE_{UR}) / (df_R - df_{UR})}{MSE_{UR}}.$$

If the estimated lagged coefficient b_i^{j0} is statistically significant, then it can be inferred that changes in the macroeconomic variable j_0 causes changes in the NAV returns/variance of returns of the mutual fund scheme.

Analysis & Interpretation

Causality on returns

The results of the Granger causality tests for the macroeconomic variables on the returns of the sample mutual fund schemes are shown in Table 1.

It was found that there was significant causality from inflation to 23.53% of the sample schemes; from crude oil prices to 35.29% of the sample schemes; from MIBOR to 23.53% of the sample schemes; from INR/USD to 17.65% of the sample schemes; from ISD/EURO to 23.53% of the sample schemes; and from SENSEX to 23.53% of the sample schemes. Thus, crude oil prices had the greatest influence on the returns of mutual fund schemes.

Further, it was found that the returns of 35.29% of the sample schemes were significantly influenced by the macroeconomic variables considered. The returns of Reliance Banking Fund - Growth Plan was found to be highly sensitive to changes in all of the macroeconomic variables. The returns of Reliance NRI Equity Fund - Growth Plan were also found to be very sensitive to all of the macroeconomic variables, but to a lesser extent than those of Reliance Banking Fund - Growth Plan. The returns of Franklin India Bluechip Fund - Growth were found to be sensitive to all the macroeconomic variables except for INR/EURO. The returns of Reliance Growth Fund - Growth Plan - Bonus Option were found to be sensitive to changes in crude oil prices, MIBOR, and INR/EURO. The returns of Canara Rebeco Equity Tax Saver Scheme were found to be sensitive to changes in inflation, crude oil prices, and SENSEX. The returns of Reliance Tax Saver (ELSS) Fund - Growth Plan were found to be sensitive to changes in crude oil prices and INR/EURO. The returns of the remaining 64.71% of the sample schemes were not sensitive to any of the macroeconomic variables considered.

Causality on variance of returns

The results of the Granger causality tests for the macroeconomic variables on the variance of returns of the sample mutual fund schemes are shown in Table 1.

It was found that there was significant causality from inflation to 17.65% of the sample schemes; from crude oil prices to 17.65% of the sample schemes; from MIBOR to 23.53% of the sample schemes; from INR/USD to 17.65% of the sample schemes; from ISD/EURO to 11.76% of the sample schemes; and from SENSEX to 35.29% of the sample schemes. Thus, SENSEX had the greatest influence on the variance of returns of mutual fund schemes.

Further, it was found that the variance of returns of 47.06% of the sample schemes were significantly influenced by the macroeconomic variables considered. The variance of returns of Canara Robeco EXPO Scheme was found to be highly sensitive to changes in all of the macroeconomic variables. The variance of returns of Reliance Growth Fund - Growth Plan - Bonus Option was also found to be very sensitive to all of the macroeconomic variables, but to a lesser extent than that of Canara Robeco EXPO Scheme. The variance of returns of Franklin India Bluechip Fund - Growth was found to be sensitive to changes in crude oil prices, MIBOR, and SENSEX. The variance of returns of Reliance Regular Savings Fund - Debt Plan - Growth Option was found to be sensitive to changes in inflation and INR/USD. The variance of returns of Canara Robeco CIGO Scheme was found to be sensitive to changes in MIBOR. The variances of returns of Reliance Tax Saver (ELSS) Fund - Growth, Reliance Media & Entertainment Fund - Growth Plan, and Franklin India Index Fund - BSE Plan - Growth Plan were found to be sensitive to changes in SENSEX. The variance of returns of the remaining 52.94% of the sample schemes were not sensitive to any of the macroeconomic variables considered.

Overall results

It was found that the returns and variance of returns of Reliance Growth Fund - Growth Plan - Bonus Option, Reliance Tax Saver (ELSS) Fund - Growth Plan, and Franklin India Bluechip Fund – Growth were significantly affected by the macroeconomic variables. Also, the returns and variance of returns of 35.29% of the sample schemes were not sensitive to any of the macroeconomic variables considered.

Discussion

In recent times there is high volatility in the market due to increase in inflation and crude oil prices and other unfavorable changes in the market. Though all these variables affect mutual fund returns, changes in the specific variables cause intense change in returns of a specific scheme. The NAV of many mutual fund schemes have dropped due to unfavorable changes in the macro economic variables. By knowing which factors affect a scheme and to what extent they do so, the fund manager can take necessary precautions so that the damage done is minimal. Thus the Granger causality model can act as important tool in finding out what causes the changes in the returns. By identifying and monitoring the causes of returns, potential loss can be minimized and returns can be maximized.

The results of these causality tests has identified the specific macroeconomic factors which affect the returns and volatility of particular mutual fund schemes, which, on the one hand, would enable fund managers to manage the risk profiles of their portfolios more effectively; and, on the other hand, would enable investors to understand the specific risk factors affecting their investments, so that they can take more informed investment decisions pertaining to mutual funds.

There were several limitations inherent in the study. Firstly, the data was entirely secondary, collected from different official website. Secondly, the research period was for ninety-one weeks only, due to availability of data. Also, the macroeconomic variables used in the study were not exhaustive; some variables were excluded due to inadequacy of data. In fact, the results show that the returns and variance of returns of 35.29% of the sample schemes were not sensitive to any of the macroeconomic variables considered. This suggests that other macroeconomic variables should also be considered to explain mutual fund scheme returns and variance of returns.

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Table 1. Granger causality tests for macroeconomic variables on the returns of the sample mutual fund schemes

	INFLATION	CRUDE OIL PRICES	MIBOR	INR/ USD	INR/ EURO	SENS EX
Canara Robeco Equity Tax Saver Scheme	4.7393	4.9543	1.9236	2.0903	3.5822	3.7419
	0.0246	0.0218	0.1976	0.1686	0.0507	0.0455
Canara Robeco Income Scheme	2.4280	1.9407	1.1475	1.1803	2.4938	2.8677
	0.1243	0.1944	0.4431	0.4275	0.1174	0.0862
Canara Robeco CIGO Scheme	1.3131	0.6839	0.7292	0.3828	0.6042	0.9311
	0.3701	0.7249	0.6931	0.9251	0.7815	0.5608
Canara Robeco Emerging Equities Scheme	0.6915	0.5164	0.7825	1.5445	1.1641	0.6613
	0.7196	0.8427	0.6565	0.2895	0.4351	0.7409
Canara Robeco Gilt PGS Scheme	0.6915	0.0514	0.8882	1.3305	1.3421	0.7357
	0.7196	1.0000	0.5873	0.3632	0.3588	0.6886
Canara Robeco EXPO Scheme	0.2967	0.4479	0.3424	0.4763	0.1417	0.6131
	0.9645	0.8874	0.9452	0.8693	0.9976	0.7752
Canara Robeco Infrastructure Scheme	2.7058	2.6237	2.8582	3.5155	3.0850	1.4432
	0.0982	0.1051	0.0868	0.0531	0.0728	0.3220
Reliance Banking Fund-Growth Plan	17.5927	21.9714	15.7508	16.5225	19.2605	20.3017
	0.0005	0.0002	0.0007	0.0006	0.0003	0.0003
Reliance Diversified Power Sector Fund-Growth	1.2225	2.3401	1.4984	1.7463	1.7005	1.1786

	0.4083	0.1342	0.3038	0.2354	0.2466	0.4283
Franklin India Bluechip Fund-Growth	6.1427	9.7506	6.1239	6.4545	2.7645	6.2746
	0.0120	0.0030	0.0121	0.0104	0.0936	0.0113
Reliance Tax Saver (ELSS) Fund-Growth Plan	3.1183	4.3409	2.8004	3.1147	5.1817	2.9805
	0.0709	0.0310	0.0909	0.0711	0.0193	0.0789
Reliance NRI Equity Fund-Growth Plan	6.9921	6.5665	4.8733	6.0178	6.0872	5.1170
	0.0082	0.0099	0.0228	0.0127	0.0123	0.0200
Reliance Regular Savings Fund-DEBT PLAN-Growth Option	0.0927	1.5775	0.4081	1.3101	0.6778	1.0617
	0.9996	0.2797	0.9111	0.3713	0.7293	0.4866
Reliance Growth Fund-Growth Plan-Bonus Option	3.3365	4.3332	3.6195	3.2829	4.9135	2.9372
	0.0604	0.0312	0.0494	0.0628	0.0223	0.0816
Reliance Media & Entertainment Fund-Growth Plan	1.7741	1.8189	1.5614	1.7111	1.9150	1.7313
	0.2290	0.2190	0.2845	0.2439	0.1993	0.2390
Franklin India Index Fund - BSE Plan - Growth Plan	1.4091	1.2291	0.5072	1.7780	0.6678	1.0540
	0.3339	0.4054	0.8490	0.2281	0.7364	0.4907
Franklin FMCG Fund - Dividend	1.2576	1.1241	1.0456	1.0104	1.0983	1.2679
	0.3930	0.4546	0.4953	0.5147	0.4676	0.3887

Table 2. Granger causality tests for macroeconomic variables on the variance of returns of the sample mutual fund schemes

	INFLATION	**CRUDE OIL PRICES**	**MIBOR**	**INR/ USD**	**INR/ EURO**	**SENS EX**
Canara Robeco Equity Tax Saver Scheme	0.3267	0.2425	0.3200	0.4228	0.3901	3.3395
	0.9523	0.9817	0.9552	0.9025	0.9211	0.0602
Canara Robeco Income Scheme	0.2600	0.3468	0.2094	0.1838	0.2725	0.1823
	0.9768	0.9432	0.9891	0.9933	0.9730	0.9935
Canara Robeco CIGO Scheme	1.4989	3.1235	7.8565	1.6474	2.3218	2.4939
	0.3036	0.0707	0.0058	0.2603	0.1364	0.1174
Canara Robeco Emerging Equities Scheme	0.7012	1.1836	1.2637	0.9697	1.6649	2.3853

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	0.7127	0.4260	0.3904	0.5379	0.2557	0.1290
Canara Robeco Gilt PGS Scheme	0.6524	0.9623	0.5152	0.6491	0.3079	1.0562
	0.7473	0.5423	0.8436	0.7496	0.9602	0.4896
Canara Robeco EXPO Scheme	36.9978	29.1519	21.2693	33.361 5	42.5728	37.088 6
	0.0000	0.0001	0.0002	0.0001	0.0000	0.0000
Canara Robeco Infrastructure Scheme	0.3531	0.6146	0.3961	0.4177	0.3580	1.9913
	0.9402	0.7742	0.9178	0.9055	0.9378	0.1851
Reliance Banking Fund-Growth Plan	0.3707	0.3858	0.1781	0.4060	0.1899	0.4230
	0.9314	0.9234	0.9941	0.9122	0.9924	0.9024
Reliance Diversified Power Sector Fund-Growth	0.7709	0.9983	0.8439	0.6327	0.3986	1.5643
	0.6643	0.5215	0.6156	0.7613	0.9165	0.2836
Franklin India Bluechip Fund-Growth	2.2005	4.5809	3.8785	1.7544	0.9903	94.087 9
	0.1522	0.0269	0.0415	0.2335	0.5260	0.0000
Reliance Tax Saver (ELSS) Fund-Growth Plan	1.6398	2.8870	1.7719	0.9081	1.2838	4.8563
	0.2623	0.0849	0.2295	0.5749	0.3820	0.0230
Reliance NRI Equity Fund-Growth Plan	0.3739	0.3291	0.3729	0.4410	0.4542	1.8096
	0.9297	0.9512	0.9303	0.8916	0.8834	0.2210
Reliance Regular Savings Fund-DEBT PLAN-Growth Option	4.8952	1.8995	1.7883	3.9916	3.0896	3.1104
	0.0225	0.2023	0.2257	0.0386	0.0725	0.0714
Reliance Growth Fund-Growth Plan-Bonus Option	12.9000	12.2648	7.4732	5.7736	5.3781	21.737 0
	0.0013	0.0015	0.0068	0.0143	0.0174	0.0002
Reliance Media & Entertainment Fund-Growth Plan	1.2061	1.8730	0.8656	0.9970	1.2024	21.737 0
	0.4156	0.2076	0.6016	0.5222	0.4173	0.0002
Franklin India Index Fund - BSE Plan - Growth Plan	1.0489	1.4985	1.2616	2.2788	0.9953	449.70 40
	0.4935	0.3038	0.3913	0.1418	0.5232	0.0000
Franklin FMCG Fund - Dividend	0.1722	0.1648	0.2422	0.1955	0.2199	0.4608
	0.9948	0.9956	0.9818	0.9916	0.9870	0.8792