Investigation of Dynamics of Macroeconomy and Commodity Mutual Funds: Empirical Evidence from India

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Abstract

Researchers discuss the effect of macroeconomics on the stock market but usually, effects on portfolios like the mutual funds are not very popular. In this research, an attempt was made to study the same. A longitudinal, exploratory study was performed taking three year daily (net asset value) NAVs of 41 mutual funds belonging to two categories (gold funds and energy funds) and series of 9 macroeconomic variables and analysed using time series methods to judge and highlight their impact on the chosen funds. Different macroeconomic variables were found to affect the two categories of funds differently. Investment in energy funds increased whenever there was an increase in money supply. Interest rates had a positive impact on gold mutual fund net asset values. Own fund information was found to have the major impact when excited with one standard deviation shock. The causality between various mutual funds and macroeconomic variables was established. The study highlighted the need to understand the global scenario by both the investor and the mutual fund manager. Since the macroeconomic variables interplay and affect the mutual funds, their understanding would help in stitching more profitable schemes.

1. Introduction

Indian economy is insulated from the foreign world to some extent as the in-

vestments abroad are less. The investments of FIIs and FDIs are also less as compared to the massive investments by Indian investors. Indian Rupee has been depreciating for quite some time now, but the efforts are on to stabilize this fall. Currency appreciation, depreciation, devaluation etc. all depend on the market forces *i.e.* supply and demand. If the currency depreciates it benefits the exporters and if it appreciates it benefits the importers. RBI can also control the exchange rates to some extent by the use of foreign currency reserves. Whenever there is some rumor in the market arousing suspicion for the performance of companies, or there is some corporate disclosure, or some movement in the global markets, the investors start buying or selling shares aggressively thus affecting the stock markets. Government policies, national and international events, natural calamities, wars etc. all influence the market movements, investments, exports, and imports. The investor perceptions change very quickly based on the experience of other people. Thus it is important to know what all factors will affect the performance of stocks and in our study the performance of mutual funds.

In the above backdrop, we define the objectives of our research as follows:

- To examine the effect of various macroeconomic factors on mutual funds' performance and their relational outcome.
- To establish the causality between various macroeconomic variables and the select mutual funds.

2. Literature Review

From previous researches, it is evident that mutual funds' performance is affected by macroeconomic factors and investor sentiments. The interplay of these governs the actual investment volume. With the change in exchange rate, inflation rate, interest rates etc., the common investor becomes skeptical about the economic condition of the country and withholds his decisions regarding investments.

Ahmad *et al.* [1] explored the long term and short term causal relationship between NASDAQ, Nikkei, NSE and BSE stock exchanges using Johansen cointegration and Granger causality tests. It was found that there was the absence of long-term co-movement and relationship between the Indian and the US/ Japanese stock markets.

An attempt to understand the concept of mutual funds was made by Gera [2] and he explained its types and benefits. He identified the population, global market movement, GDP composition, inflation and composition of financial savings as macroeconomic factors affecting mutual fund industry in India.

Dash and Kumar [3] studied the effect of select macroeconomic variables upon the Indian mutual fund schemes' returns and volatility. A huge percentage of sample schemes were found to be insensitive to the selected macroeconomic variables, which showed that some other macroeconomic variables are also influencing them which need to be included in future studies.

Gupta and Siddiqui [4] examined the effect of select macroeconomic factors on Indian stock market with respect to the manner of information absorption.

Srivastava [5] studied the effect of macroeconomic variables on Indian stock market. It was found that IIP, interest rate and WPI had a relatively more significant impact on long-term stock market pricing in India.

Shukla [6] introduced the importance of macroeconomic factors that give rise to risks and uncertainty. He evaluated the interrelationship of macroeconomic variables and AUM of mutual funds.

Khalid [7] studied the long-term co-movement of macroeconomic variables (inflation, exchange rate & Treasury bill) and Karachi stock exchange return (KSE100). It was found that there was an absence of significant correlation among variables and no evidence of cointegration of variables with share prices existed.

Menike 2006 (as cited in Khalid [7]) performed a study on Sri Lankan stock exchange using multivariate regression model. The monthly data for the period 1991 to 2002 was used. It was found that inflation rate, interest rate, and money supply caused great impact on stock prices.

Patel [8] investigated the effects of selected macroeconomic determinants on Indian stock market performance. A long run relation was found between stock market indices and macroeconomic variables.

Joshi [9] explained the Indian market structure and made an extensive & systematic study of factors affecting stock market movements. Opinion survey involving personal interviews of 56 stockbrokers, sub-brokers, and their employees was done.

Singhania and Anchalia [10] studied the effect of the financial global crisis on the stock returns volatility of Hong Kong, China, Japan and India using EGARCH. The time series analysis showed that the crisis had a positive impact on returns of Japan, India, and China. Volatility clustering, asymmetry, persistence and leverage effects were also noticed in all the stock return series.

Abdul and Sarvani [11] studied the macroeconomic factors affecting select Indian equity funds and appraise the mutual funds' performance using Sharpe and Treynor models. HDFC top 200 fund & BNP Paribas equity fund, Franklin India Prima plus fund, UTI mid-cap fund and ICICI Prudential tax plan-(R) emerged the top performers in the various chosen categories of equity schemes.

Based on some previously hypothesized macroeconomic variables, Burmeister *et al.*, 1986-88 (as cited in Abdul and Sarvani [11]) used a multi-index model set and found five variables which according to their research were sufficient to describe any security's return.

Marshall, 1992 (as cited in Abdul and Sarvani [11]) found that real fluctuations in the economy, monetary fluctuations or both had a negative effect on stock returns due to the effect on inflation.

Kumar and Gautam [12] studied the effect of FII & volatility of other stock exchanges (FTSE 100, NIKKEI 225 & NASDAQ 100) on BSE volatility. The researchers suggested taking NIFTY stock exchange or blocks of stock exchanges

for future analysis. The studies can also include long term, short term analysis and various other statistical models like GARCH, ARCH, ARIMA, ARMA etc.

Sanningammanavara *et al.* [13] studied the influence of eight economic indicators [(GDP) growth rate, exchange rate, gross capital formation (GCF), unemployment rate, inflation rate, gross domestic savings (GDS), interest rate and net (FDI)] on the performance of the stock market and propose a model for it. It was concluded that economic indicators affect stock market to an extent of 77.20%.

Singh [14] assessed the impact and causal relationship between macroeconomic variables and the Indian stock market (BSE Sensex and S & P CNX Nifty). Industrial production index, money supply (M3), trade deficit, exchange rate. Gold price, crude oil price, wholesale price index. 91 day T-bill (as interest rate proxy IR) and foreign institutional investment (FII) were taken as independent variables. It was concluded that investors were more interested in gold rather than security investment.

Granger causality tests, vector error correction model, and Engle-granger cointegration tests were used by Kwon and Shin, 1999 (as cited in Singh [14]) to test macroeconomic variables' relationship with Korean stock market index.

A long run relationship between selected macroeconomic variables (foreign reserves, inflation, exports, interest rates and industrial production) and Jordanian stock prices was investigated by Maghayereh, 2003 (as cited in Singh, [14]) using monthly time series data.

Erdogan and Ozlale, 2005 (as cited in Singh [14]) performed a study to assess the relationship between Turkey stock returns and macroeconomic variables. It was concluded that exchange rates and Industrial production positively affected stock returns while circulation in money (M1) showed insignificant influence on stock returns.

Short and long-term interest rates, exchange rates, money supply, inflation rate, GDP and domestic retail oil prices were chosen as variables to examine their effect on New Zealand stock prices by Gan *et al.*, 2006 (as cited in Singh, [14]). A significant long-run relationship was revealed. Granger causality tests highlighted that causality did not run from Stock exchange to macroeconomic variables.

The impact of various macroeconomic variables like Industrial production index, money supply, exchange rates, wholesale price index and treasury bill rates on Indian BSE Sensex was studied by Naik and Padhi, 2012 (as cited in Singh [14]). Insignificant association of interest rates & exchange rates with stock prices was reported.

A study was performed by Sireesha, 2013 (as cited in Singh [14]) to test the effect of macroeconomic variables on Indian stock market index Nifty, silver, and gold prices. Inflation and GDP were found to influence stock returns while gold was affected by money supply.

Mishra and Gupta, 2014 (as cited in Singh [14]) studied the factors responsible for movement in Indian stock market (BSE Sensex). For this IIP, interest

rate, WPI and MSCI were chosen as independent macroeconomic variables. A positive relation was found between Sensex and the chosen variables.

In their study, Choudhary *et al*. [15] used non-linear cointegration and causality tests to explore the influence of Indian copper price volatility on Sensex, exchange rate and international copper prices.

A study by Mohanasundari and Vidhyapriya [16] from 2011-2014 explored investor's perception about tax saving mutual fund schemes and its effect on the selection of schemes. The study identified economic factors, regulatory & management factors and external factors.

Since we are working on mutual funds, we wish to find out that what happens when the global stage is set on fire, or more so what happens when some of the variables of macro economy are changed. How does the market responds to this sudden change? From the previous studies, it has also been seen that various macroeconomic variables are inter-related. The change in one can lead to a drastic change in other. The common investor should be aware of these variables and must know how they interplay and seep into the stock markets and destroy their investments. We here perform this study taking few macroeconomic variables and all the gold and energy mutual funds of India.

3. Research Design

The study is exploratory and causal as it first tries to find out the influence of macroeconomic variables on mutual funds and then tries to establish causality between them. The study takes three years of data for study and performs a longitudinal analysis. We took Gold and Energy mutual funds for analysis. The reason is the "hedging effect" *i.e.* when the stock markets tumble, investors look towards alternate investment avenues. Also, Gold has always been the safe haven for parking money. In the current scenario, energy funds are also doing well and are good investment avenues. The other reason for selecting these funds was that we wanted to study the effect of macroeconomic variables on the mutual funds. Commodities are the most affected avenues as far as macroeconomic shocks are concerned. Hence we selected commodity mutual funds. Since it is difficult to cover all the commodities, we took the most volatile commodity funds which happen to be gold and energy mutual funds.

3.1. Sample Selection

We compiled the NAV series of forty-one mutual funds from Mutualfundindia.com website and Bloomberg database. The time period of study was three years from January 2013 to January 2016 highlighting the fact that the study is longitudinal in nature. Fourteen of these were the gold mutual funds, 12 were gold exchange-traded funds and 15 were energy mutual funds (chosen because literature review showed that no work has been done previously on these categories of funds). Various macroeconomic variables like US dollar exchange rate, crude oil price, gold price, silver price, money supply, foreign exchange reserves, interest rate, Sensex and Nifty have been chosen for analysis. For the conveni-

ence of analysis, all the funds were numbered from f_1 to f_41 and all the macroeconomic variables taken were numbered from M_1 to M_9 (names and groups in Table A1 and Table A2 in **Appendix**).

3.2. Research Hypothesis

Based on our research objectives, we framed a few hypothesis to verify with our research.

Ho_1: USD exchange rate does not have a significant effect on mutual fund net asset value.

Ho_2: Crude oil price does not have a significant effect on mutual fund net asset value.

Ho_3: Gold price does not have a significant effect on mutual fund net asset value.

Ho_4: Silver price does not have a significant effect on mutual fund net asset value.

Ho_5: Money supply does not have a significant effect on mutual fund net asset value.

Ho_6: foreign exchange reserves do not have a significant effect on mutual fund net asset value.

Ho_7: Interest rate does not have a significant effect on mutual fund net asset value.

Ho_8: Sensex does not have a significant effect on mutual fund net asset value.

Ho_9: Nifty does not have a significant effect on mutual fund net asset value.

For justification of the above stated hypothesis, we followed non-stationary time series analysis pathway. We began with unit root test for checking the non stationarity, followed by cointegration tests and vector error correction models to establish the cointegration direction and strength. The series that possessed cointegration were further tested for short term causality using granger causality test. Then the results from all the above analysis were further confirmed by giving impulses of own series and all the macroeconomic variables. These impulses were of one standard deviation equivalent. The results of impulse response were desicated by variance decomposition method. Here it was seen that how much variation in NAV series was caused due to which impulse.

4. Methodology

The methodology starts with the application of unit root test for stationarity. After performing unit root test, we see that if the series are non-stationary, then they should get stationary at the same level after differencing. If they get stationary at the same level, then we can say that they are integrated of that order and can proceed further with cointegration. For getting the cointegration equations, we apply vector error correction mechanism (VECM) and construct error correction equations. The coefficients of these equations tell about the speed of adjustment of the variable. To see short-run relationship, we perform Granger causality which is a concept based on the idea of succession in time. To make the

results more evidential, we next give impulse of macroeconomic variables and funds information to the fund value. To see how much shock is coming from the exogenous variables and how much from the fund information itself, we decompose the variation caused and see which variable has caused how much variance in the fund value. We have followed these steps and have framed the results with respect to all the tests conducted.

Proposed Model

The mutual fund net asset prices and the various macroeconomic variables are implicitly depicted as:

$$NAV = f\left(USD, OIL, GLD, SLVR, MS, FER, IR, SENSEX, NIFTY\right) \qquad (1)$$

where, NAV refers to the net asset value of the chosen mutual fund and the right hand side variables are the US dollar exchange rate with Indian rupee (USD), crude oil price (OIL), gold price (GLD), silver price (SLVR), money supply in the country (MS), foreign exchange reserves (FER), interest rate (IR), Sensex and Nifty indices.

5. Data Analysis Results

5.1. Stationarity Test

We performed stationarity test (Table 1 and Table 2) to see whether our series are stationary or non-stationary. When Augmented Dickey Fuller Unit root stationarity test was performed at level, the absolute value of ADF test statistics for all the mutual funds and the macroeconomic variables were found to be less than the absolute critical values at one percent and five percent levels of significance. The p-values were found to be higher than the levels of significances, hence we accept Ho, *i.e.* the series have unit roots and are thus non-stationary. The number of lags for the test have been selected on the basis of Schwarz criterion. From the tables, it can also be seen that the ADF statistics were more than the absolute critical values at one percent and five percent levels of significance when the ADF test was performed after taking first difference for all the sample series. Also, the p-value (0.000) was less than 0.05, which shows rejection of the null hypothesis. Thus the series are now stationary at first difference and are said to be integrated of order I.

5.2. Cointegration Test

Since all the series were found to be integrated of order 1, we performed Johansen cointegration test for each group. Every group consisted of one mutual fund and all the nine macroeconomic variables. The trace test and the maximum eigen-value test indicated a different number of cointegrating equations in each group.

It was seen that according to Johansen cointegration test, each group contains cointegrating equations. The output of the test was used to find vector error correction equation to know the error correction speed whenever the cointegrating series are disturbed due to shock.

Table 1. ADF test of mutual fund series.

Mutual fund	ADF statistic at level	Test critical values at 1% level of significance	Test critical values at 5% level of significance	Test critical values at 10% level of significance	P-value	ADF statistic at 1st difference	Test critical values at 1% level of significance	Test critical values at 5% level of significance	Test critical values at 10% level of significance	P-value
f_1	−2.771123	−3.544063	−2.910860	−2.593090	0.068500	−8.343738	−3.546099	−2.911730	−2.593551	0.000000
f_2	−1.518975	−3.544063	−2.910860	−2.593090	0.517300	−7.743742	−3.546099	−2.911730	−2.593551	0.000000
f_3	−2.184721	−3.544063	−2.910860	−2.593090	0.213900	−8.101964	−3.546099	−2.911730	−2.593551	0.000000
f_4	−2.558827	−3.544063	−2.910860	−2.593090	0.107200	−9.394846	−3.546099	−2.911730	−2.593551	0.000000
f_5	−2.009690	−3.544063	−2.910860	−2.593090	0.282000	−7.601256	−3.546099	−2.911730	−2.593551	0.000000
f_6	−2.265115	−3.544063	−2.910860	−2.593090	0.186500	−8.062592	−3.546099	−2.911730	−2.593551	0.000000
f_7	−2.869932	−3.544063	−2.910860	−2.593090	0.054900	−5.839286	−3.568308	−2.921175	−2.598551	0.000000
f_8	−1.322064	−3.544063	−2.910860	−2.593090	0.613900	−7.804268	−3.546099	−2.911730	−2.593551	0.000000
f_9	−2.050167	−3.544063	−2.910860	−2.593090	0.265300	−8.206944	−3.546099	−2.911730	−2.593551	0.000000
f_10	−2.153083	−3.544063	−2.910860	−2.593090	0.225400	−8.666955	−3.546099	−2.911730	−2.593551	0.000000
f_11	−2.064209	−3.544063	−2.910860	−2.593090	0.259600	−8.493626	−3.546099	−2.911730	−2.593551	0.000000
f_12	−2.165960	−3.544063	−2.910860	−2.593090	0.227100	−7.332969	−3.546099	−2.911730	−2.593551	0.000000
f_13	−2.690280	−3.544063	−2.910860	−2.593090	0.081600	−7.139850	−3.546099	−2.911730	−2.593551	0.000000
f_14	−2.127609	−3.544063	−2.910860	−2.593090	0.234900	−8.309649	−3.546099	−2.911730	−2.593551	0.000000
f_15	−2.049778	−3.544063	−2.910860	−2.593090	0.066000	−5.787755	−3.568308	−2.921175	−2.598551	0.000000
f_16	−2.033060	−3.544063	−2.910860	−2.593090	0.067500	−5.770883	−3.568308	−2.921175	−2.598551	0.000000
f_17	−2.765677	−3.544063	−2.910860	−2.593090	0.069300	−8.437351	−3.546099	−2.911730	−2.593551	0.000000
f_18	−2.648665	−3.544063	−2.910860	−2.593090	0.089100	−8.130755	−3.546099	−2.911730	−2.593551	0.000000
f_19	−2.074736	−3.544063	−2.910860	−2.593090	0.073900	−5.791633	−3.568308	−2.921175	−2.598551	0.000000
f_20	−2.034451	−3.544063	−2.910860	−2.593090	0.057400	−5.782584	−3.568308	−2.921175	−2.598551	0.000000
f_21	−2.035310	−3.544063	−2.910860	−2.593090	0.067300	−8.050313	−3.546099	−2.911730	−2.593551	0.000000
f_22	−2.059742	−3.544063	−2.910860	−2.593090	0.065100	−5.794623	−3.568308	−2.921175	−2.598551	0.000000
f_23	−2.889992	−3.544063	−2.910860	−2.593090	0.052500	−8.445508	−3.546099	−2.911730	−2.593551	0.000000
f_24	−2.017811	−3.544063	−2.910860	−2.593090	0.058900	−5.785990	−3.568308	−2.921175	−2.598551	0.000000
f_25	−2.078674	−3.544063	−2.910860	−2.593090	0.063600	−8.033548	−3.546099	−2.911730	−2.593551	0.000000
f_26	−2.023827	−3.544063	−2.910860	−2.593090	0.058300	−8.020354	−3.546099	−2.911730	−2.593551	0.000000
f_27	−1.004166	−3.544063	−2.910860	−2.593090	0.746500	−7.659445	−3.546099	−2.911730	−2.593551	0.000000
f_28	−0.704624	−3.544063	−2.910860	−2.593090	0.837400	−7.334186	−3.546099	−2.911730	−2.593551	0.000000
f_29	−0.670113	−3.544063	−2.910860	−2.593090	0.846000	−7.791967	−3.546099	−2.911730	−2.593551	0.000000
f_30	−0.646962	−3.544063	−2.910860	−2.593090	0.851600	−7.039387	−3.546099	−2.911730	−2.593551	0.000000
f_31	−0.255373	−3.544063	−2.910860	−2.593090	0.924700	−6.754967	−3.546099	−2.911730	−2.593551	0.000000
f_32	−0.945031	−3.544063	−2.910860	−2.593090	0.767000	−7.357812	−3.546099	−2.911730	−2.593551	0.000000
f_33	−0.663167	−3.544063	−2.910860	−2.593090	0.847700	−7.690004	−3.546099	−2.911730	−2.593551	0.000000
f_34	−0.621744	−3.544063	−2.910860	−2.593090	0.857500	−6.824495	−3.546099	−2.911730	−2.593551	0.000000
f_35	−0.368118	−3.544063	−2.910860	−2.593090	0.907400	−6.875377	−3.546099	−2.911730	−2.593551	0.000000
f_36	−0.677402	−3.544063	−2.910860	−2.593090	0.844200	−6.868468	−3.546099	−2.911730	−2.593551	0.000000
f_37	−0.817272	−3.544063	−2.910860	−2.593090	0.806800	−7.079072	−3.546099	−2.911730	−2.593551	0.000000
f_38	−0.586640	−3.544063	−2.910860	−2.593090	0.865400	−6.536958	−3.546099	−2.911730	−2.593551	0.000000
f_39	−0.690882	−3.544063	−2.910860	−2.593090	0.840900	−7.935993	−3.546099	−2.911730	−2.593551	0.000000
f_40	−0.793372	−3.544063	−2.910860	−2.593090	0.813600	−7.396123	−3.546099	−2.911730	−2.593551	0.000000
f_41	−0.507871	−3.544063	−2.910860	−2.593090	0.881900	−6.252981	−3.546099	−2.911730	-2.593551	0.000000

Table 2. ADF test of macroeconomic series.

Macroeconomic variable	ADF statistic at level	Test critical values at 1% level of significance	Test critical values at 5% level of significance	Test critical values at 10% level of significance	P-value	ADF statistic at 1st difference	Test critical values at 1% level of significance	Test critical values at 5% level of significance	Test critical values at 10% level of significance	P-value
M_1	−2.771123	−3.544063	−2.910860	−2.593090	0.068500	−8.343738	−3.546099	−2.911730	−2.593551	0.000000
M_2	−1.518975	−3.544063	−2.910860	−2.593090	0.517300	−7.743742	−3.546099	−2.911730	−2.593551	0.000000
M_3	−2.184721	−3.544063	−2.910860	−2.593090	0.213900	−8.101964	−3.546099	−2.911730	−2.593551	0.000000
M_4	−2.558827	−3.544063	−2.910860	−2.593090	0.107200	−9.394846	−3.546099	−2.911730	−2.593551	0.000000
M_5	−2.009690	−3.544063	−2.910860	−2.593090	0.282000	−7.601256	−3.546099	−2.911730	−2.593551	0.000000
M_6	−2.265115	−3.544063	−2.910860	−2.593090	0.186500	−8.062592	−3.546099	−2.911730	−2.593551	0.000000
M_7	−2.869932	−3.544063	−2.910860	−2.593090	0.054900	−5.839286	−3.568308	−2.921175	−2.598551	0.000000
M_8	−1.322064	−3.544063	−2.910860	−2.593090	0.613900	−7.804268	−3.546099	−2.911730	−2.593551	0.000000
M_9	−2.050167	−3.544063	−2.910860	−2.593090	0.265300	−8.206944	−3.546099	−2.911730	-2.593551	0.000000

5.3. VECM and Equation Estimation

Equations were found after seeing the significance of the constant terms and the probability value. The value of the constants was then noted and the equations formed. The following equations were formed:

$$D(f\_1) = -0.70 * D(f\_1(-2)) + 130.54 * D(M\_7(-1)) \tag{2}$$

$$D(f\_2) = 0.36 * D(M\_7(-1)) \tag{3}$$

$$D(f\_3) = 0.38 * D(M\_7(-1)) \tag{4}$$

$$D(f\_4) = -0.51 * D(f\_4(-1)) + 0.39 * D(M\_7(-1)) \tag{5}$$

$$D(f\_5) = -0.56 * D(f\_5(-2)) + 0.35 * D(M\_7(-1)) \tag{6}$$

$$D(f\_6) = -0.49 * D(f\_6(-2)) + 0.34 * D(M\_7(-1)) \tag{7}$$

$$D(f\_7) = 0.38E - 05 * D(M\_6(-1)) + 0.46 * D(M\_7(-1)) \tag{8}$$

$$D(f\_8) = 0.30 * D(M\_7(-1)) \tag{9}$$

$$D(f\_9) = -0.49 * D(f\_9(-2)) + 0.45 * D(M\_7(-1)) \tag{10}$$

$$D(f\_10) = 0.46 * D(M\_7(-1)) \tag{11}$$

$$D(f\_11) = -0.60 * D(f\_11(-2)) + 0.37 * D(M\_7(-1)) \tag{12}$$

$$D(f\_12) = 0.45 * D(M\_4(-1)) + 0.40 * D(M\_4(-2)) \\ + 0.01 * D(M\_6(-1)) + 1.05 * D(M\_7(-1)) \tag{13}$$

$$D(f\_13) = 0.37 * D(M\_4(-2)) + 8.31E - 05 * D(M\_6(-1)) \\ + 0.80 * D(M\_7(-1)) \tag{14}$$

$$D(f\_14) = 0.41 * D(M\_7(-1)) \tag{15}$$

$$D(f\_15) = 0.01 * D(M\_6(-1)) + 68.35 * D(M\_7(-1)) \tag{16}$$

$$D(f\_16) = 0.01 * D(M\_6(-1)) + 138.68 * D(M\_7(-1)) \tag{17}$$

$$D(f\_17) = 0.01 * D(M\_6(-1)) + 146.35 * D(M\_7(-1)) \tag{18}$$

$$D(f\_18) = 121.29 * D(M\_7(-1)) \tag{19}$$

$$D(f\_19) = 0.01 * D(M\_6(-1)) + 135.63 * D(M\_7(-1)) \tag{20}$$

$$D(f\_20) = 0.01 * D(M\_6(-1)) + 139.47 * D(M\_7(-1)) \tag{21}$$

$$D(f\_21) = 0.01 * D(M\_6(-1)) + 14.08 * D(M\_7(-1)) \tag{22}$$

$$D(f\_22) = 0.01 * D(M\_6(-1)) + 142.46 * D(M\_7(-1)) \tag{23}$$

$$D(f\_23) = 0.01 * D(M\_6(-1)) + 156.32 * D(M\_7(-1)) \tag{24}$$

$$D(f\_24) = 0.01 * D(M\_6(-1)) + 13.67 * D(M\_7(-1)) \tag{25}$$

$$D(f\_25) = 0.01 * D(M\_6(-1)) + 140.44 * D(M\_7(-1)) \tag{26}$$

$$D(f\_26) = 0.01 * D(M\_6(-1)) + 136.11 * D(M\_7(-1)) \tag{27}$$

$$D(f\_29) = 0.52 * D(M\_5(-1)) \tag{28}$$

$$
\begin{aligned}
D(f\_30) = 0.03 * (&f\_30(-1) - 1.70 * M\_1(-1) - 3.57 * M\_2(-1) \\
&+ 0.64 * M\_3(-1) - 19.99 * M\_4(-1) + 3.45 * M\_5(-1) \\
&+ 0.01 * M\_6(-1) - 17.60 * M\_7(-1) + 0.52 * M\_8(-1) \\
&- 1.75 * M\_9(-1) - 94.57) + 1.39
\end{aligned}
\tag{29}
$$

$$
\begin{aligned}
D(f\_31) = 0.04 * (&f\_31(-1) - 1.50 * M\_1(-1) - 0.68 * M\_2(-1) \\
&+ 0.05 * M\_3(-1) - 2.23 * M\_4(-1) + 0.76 * M\_5(-1) \\
&+ 7.45E - 05 * M\_6(-1) - 1.91 * M\_7(-1) \\
&+ 0.09 * M\_8(-1) - 0.30 * M\_9(-1) + 104.75) \\
&+ 0.49 * D(f\_31(-2)) + 0.08 * D(M\_2(-2)) + 0.25
\end{aligned}
\tag{30}
$$

$$D(f\_32) = 0.50 * D(f\_32(-2)) \tag{31}$$

$$
\begin{aligned}
D(f\_33) = 0.19 (&f\_33(-1) - 0.43 * M\_1(-1) - 0.08 * M\_2(-1) \\
&+ 0.01 * M\_3(-1) - 0.38 * M\_4(-1) + 0.36 * M\_5(-1) \\
&- 1.23E - 05 * M\_6(-1) + 0.54 * M\_7(-1) \\
&+ 0.01 * M\_8(-1) - 0.04 * M\_9(-1) + 39.09) + 0.17
\end{aligned}
\tag{32}
$$

$$
\begin{aligned}
D(f\_34) = 0.08 * (&f\_34(-1) - 0.72 * M\_1(-1) - 0.39 * M\_2(-1) \\
&+ 0.04 * M\_3(-1) - 1.61 * M\_4(-1) + 0.91 * M\_5(-1) \\
&- 4.13E - 05 * M\_6(-1) + 0.27 * M\_7(-1) \\
&+ 0.05 * M\_8(-1) - 0.18 * M\_9(-1) + 64.05) \\
&- 0.31 * D(M\_1(-1)) + 0.28
\end{aligned}
\tag{33}
$$

$$D(f\_35) = 0.20 * \big(f\_35(-1) - 0.89 * M\_1(-1) - 0.21 * M\_2(-1)$$
$$+ 0.02 * M\_3(-1) - 1.16 * M\_4(-1) + 1.53 * M\_5(-1)$$
$$- 8.79E - 05 * M\_6(-1) + 0.58 * M\_7(-1)$$
$$+ 0.04 * M\_8(-1) - 0.14 * M\_9(-1) + 101.18 \big) + 0.55$$

(34)

$$D(f\_36) = 0.20 * \big(f\_36(-1) - 0.19 * M\_1(-1) - 0.16 * M\_2(-1)$$
$$+ 0.03 * M\_3(-1) - 1.15 * M\_4(-1) + 0.51 * M\_5(-1)$$
$$+ 2.01E - 07 * M\_6(-1) - 0.07 * M\_7(-1)$$
$$+ 0.02 * M\_8(-1) - 0.08 * M\_9(-1) + 15.19 \big) + 0.24$$

(35)

$$D(f\_37) = -0.08 * \big(f\_37(-1) - 0.82 * M\_1(-1) + 0.21 * M\_2(-1)$$
$$- 0.08 * M\_3(-1) + 1.97 * M\_4(-1) + 0.61 * M\_5(-1)$$
$$+ 4.49 * M\_7(-1) - 0.04 * M\_8(-1)$$
$$+ 0.14 * M\_9(-1) + 122.94 \big) + 0.94 * D(f\_37(-2))$$
$$- 0.21 * D(M\_1(-1)) - 0.15$$

(36)

$$D(f\_38) = 0.04 * D(M\_2(-2)) + 0.16 * D(M\_5(-1)) + 0.12$$

(37)

$$D(f\_39) = 0.13 * \big(f\_39(-1) - 0.21 * M\_1(-1) - 0.10 * M\_2(-1)$$
$$+ 0.01 * M\_3(-1) - 0.66 * M\_4(-1) + 0.37 * M\_5(-1)$$
$$+ 3.67E - 06 * M\_6(-1) + 0.02 * M\_7(-1)$$
$$+ 0.02 * M\_8(-1) - 0.06 * M\_9(-1) + 10.73 \big)$$
$$+ 0.06 * D(M\_2(-2)) - 0.25 * D(M\_7(-1)) + 0.13$$

(38)

$$D(f\_40) = 0.14 * \big(f\_40(-1) - 1.01 * M\_1(-1) - 0.47 * M\_2(-1)$$
$$+ 0.05 * M\_3(-1) - 2.10 * M\_4(-1) + 1.16 * M\_5(-1)$$
$$- 3.92E - 05 * M\_6(-1) + 0.26 * M\_7(-1)$$
$$+ 0.06 * M\_8(-1) - 0.22 * M\_9(-1) + 94.42 \big) + 0.56$$

(39)

For the convenience of interpretation, the decimal points have been restricted to 2 in all cases.

From the equations (II-XXXIX) above it can be seen that gold funds were cointegrated with lags of own information and the lags of interest rate & foreign exchange reserves. In a few cases, cointegration with silver price lags was also seen. The error correction speed was very high when there was a change in interest rate but quite low when there was a change in foreign exchange reserves. Whenever there was a change in own information, the error correction speed was appreciable. The energy funds were found to be dependent on all the macroeconomic variables but the error correction speed was quite low showing a low degree of cointegration. Money supply showed good cointegration with an appreciable error correction speed when energy funds were taken. Crude oil price was also seen cointegrated with energy funds but the error correction speed was low. Own lagged information was found to have a vast impact even up to two lags.

An important point to note here is that there was no cointegration found with f_27, f_28 and f_41, all of which happen to be energy funds. Thus we can say that the indication of cointegration as seen with Johansen cointegration test was may be between the various macroeconomic variables themselves and not with these three funds. Also, funds from f_15 to f_26 are exchange-traded funds and it can be seen that they are highly cointegrated with foreign exchange reserves and interest rate, both in their first lags. A change in either of them leads to instant error correction and the speed is high in case of changes in interest rates.

5.4. Granger Causality

In Figure 1, Causality was seen running from USD exchange rate to some gold mutual funds. Since less number of samples were found to be granger caused, hence the result cannot be generalized to all the gold funds.

Granger causality ran from foreign exchange reserves to gold mutual funds (Figure 2). Every time when there was a change in foreign exchange reserves of the country, there occurred a change in gold mutual fund NAVs. Thus a good impact.

In Figure 3, Causality also ran from interest rate to all the gold mutual funds. It means that every time there was a change in interest rates, there occurred a change in the net asset value of the funds.

Silver prices were found to Granger cause some of the gold mutual funds (Figure 4). Since less number of samples were found to be granger caused, hence the result cannot be generalized to all the gold funds.

Every time there was a change in nifty index, it was followed by a change in the net asset values of some of the gold mutual funds. But since very less were found to be following, the result cannot be generalized for the entire category of gold funds (Figure 5).

Gold mutual funds and macroeconomic variables.

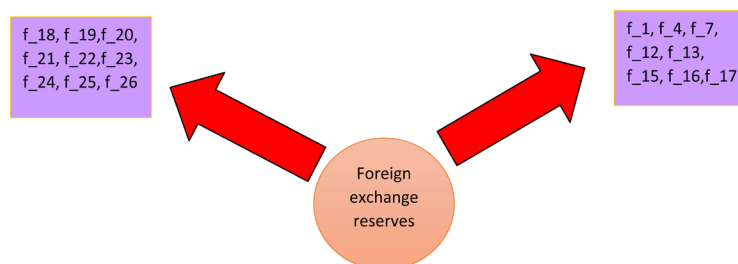**Figure 1.** Granger causality 1. (Source: researcher's analysis).

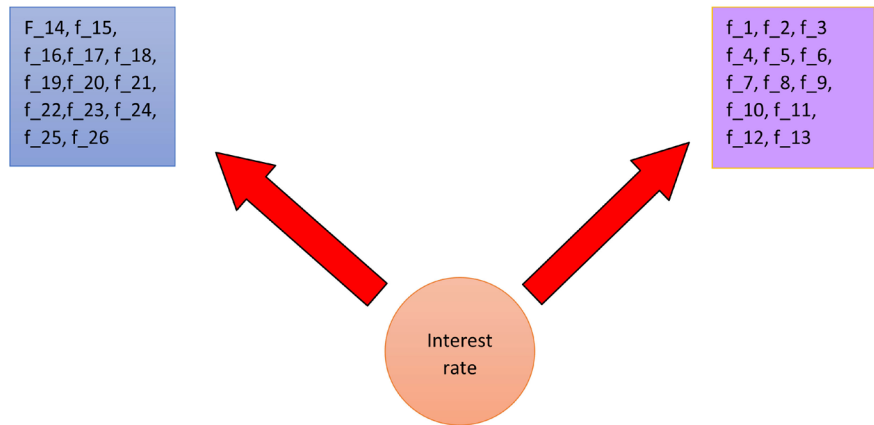**Figure 2.** Granger causality 2. (Source: researcher's analysis).

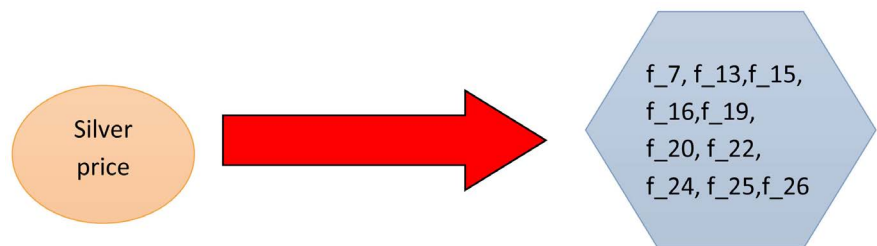Figure 3. Granger causality 3. (Source: researcher's analysis).

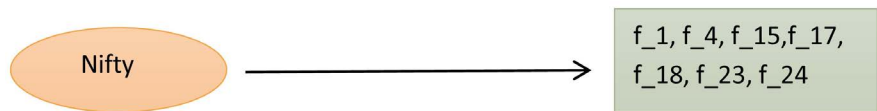Figure 4. Granger causality 4. (Source: researcher's analysis).

Figure 5. Granger causality 5. (Source: researcher's analysis).

Apart from these, money supply was found to Granger cause f_3 & f_18, Sensex index was found to Granger cause f_4, f_17 & f_18. Crude oil price granger caused f_13. These latter results, however, could not be taken as an evidence to generalize the causality in the funds.

From **Figure 6**, it can be seen that Energy funds were found to be granger caused by Sensex. Every time there is a change in Sensex, there occurs a change in net asset value of energy funds.

Nifty (in **Figure 7**) was also found to Granger cause energy funds. Every time when there is a change in Nifty index, there occurs a change in energy funds.

Figure 8 shows that Change in foreign reserves and money supply of the country led to a change in energy fund net asset values. However, due to less sample response to these variables, the results cannot be generalized for the entire category of energy funds.

Apart from this causality was also seen running from interest rate to f_28, f_36 & f_39.

Figure 9 showed that Interest rate came out as the major influencer on other macroeconomic variables. It granger caused USD exchange rate, gold price,

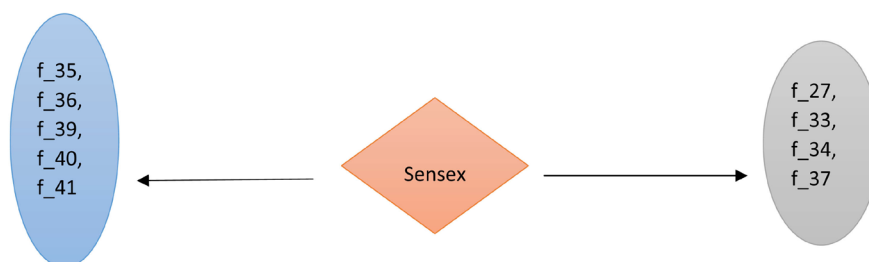**Energy funds and macroeconomic variables.**

Figure 6. Granger causality 6. (Source: researcher's analysis).
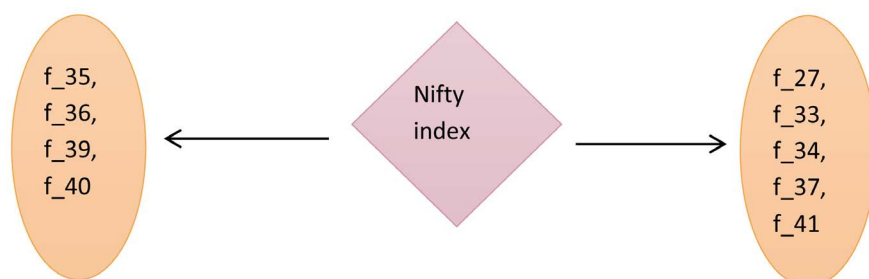
Figure 7. Granger causality 7. (Source: researcher's analysis).
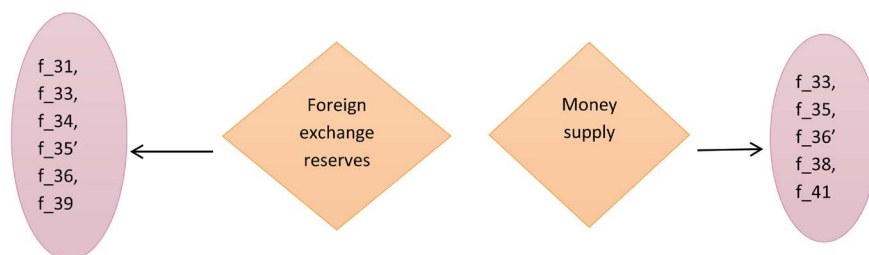
Figure 8. Granger causality 8. (Source: researcher's analysis).

Interplay of macroeconomic variables
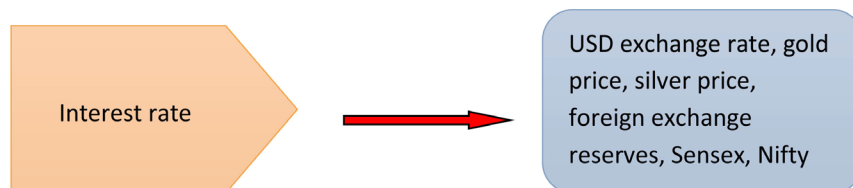
Figure 9. Granger causality 9. (Source: researcher's analysis).

silver price, foreign exchange reserves, Sensex & Nifty index. It can thus be taken as the major variable in the macroeconomic stage of our country. Apart from this Sensex and Nifty were found to Granger cause each other. Money supply and Sensex also granger caused each other. Money supply also granger caused Nifty. Gold and silver prices granger caused USD exchange rate. Foreign exchange reserves granger caused gold prices.

From the above Granger causality analysis, it can be said that foreign ex-

change reserves, interest rate, silver price all influence the gold mutual funds. Nifty index also influenced gold funds in some cases but the result cannot be generalized. Sensex and Nifty influenced energy funds and caused changes. Country's money supply and foreign exchange reserves also influenced energy funds. The interest rate was the major catalyst for changing all the other macroeconomic variables. Sensex & money supply were inter-related.

5.5. Impulse Response

When an impulse of one standard deviation of fund's own NAV's was given, it produced an immediate positive impact to the NAV's in all the funds. In some cases (like in funds f_12, f_13, f_27, f_28, f_30, f_31, f_32, f_34, f_36, f_37, f_38, f_40 & f_41) the impulse retained its immediate excited value till the end of 10 periods. In rest others, the immediately excited values lowered down to a new value which was much higher than the initial unexcited value.

USD exchange rate shock caused slight negative impact on NAV of f_2, f_3, f_5, f_7, f_8, f_9, f_11, f_12, f_13, f_21 & f_24 after an immediate null effect, which subsided to normal after 4 periods. Slight negative non diminishing effects were produced on funds f_27, f_28, f_29, f_30, f_31, f_32, f_33, f_34, f_36, f_37, f_38 & f_41. A marked negative impact was seen in funds f_1, f_15, f_16, f_17, f_18, f_19, f_20, f_22, f_23, f_25 & f_26. But in all these latter cases, the effect subsided after four periods. A point worth noting is that, there was no immediate effect of the impulse of USD exchange rate in all the funds.

The crude oil price impact had negligible effect in most of the cases. But funds like f_27, f_29, f_30, f_31, f_32, f_33, f_34, f_36 f_37, f_38, f_39 & f_41 had a slight negative impact instantly till the 2nd period which subsequently changed into a slight positive impact towards the end of 10 periods.

The gold price shock had a negligible effect on few funds. A small negative impact on NAVs was reported in fund f_12 & f_13. A small positive impact was seen on f_27, f_30, f_31, f_32, f_34, f_35, f_36, f_37, f_38 & f_39 which failed to subside over 10 periods. A Marked positive effect was found on NAVs of f_1, f_17 &f_23 but the effect subsided eventually.

Energy funds recorded no change in NAVs when an innovation of silver price was given. A slight positive diminishing effect was however witnessed in case of few gold funds like f_16, f_19, f_20, f_22, f_23, f_25 & f_26.

Next, we checked for the introduction of one standard deviation innovation in the money supply of the country. It was found that a marked subsequent negative impact occurred on funds f_1, f_15, f_16, f_17, f_18, f_19, f_20, f_22, f_23, f_25 & f_26 which fluctuated till the 6th period and then subsided. A little negative impact was witnessed in case of f_7, f_21 & f_24. Energy funds, however, presented a different picture. An increasing positive value of NAVs was seen in funds f_27, f_29, f_30, f_31, f_32, f_33, f_34, f_35, f_36, f_37, f_38, f_39, f_40 & f_41.

All the funds were exposed to one standard deviation shock in foreign exchange reserves. After initial null effect, a slight positive impact was seen in all

the gold funds while marked positive response occurred in funds f_1, f_15, f_16, f_17, f_18, f_19, f_20, f_22, f_23, f_25 & f_26. A Negligible effect was recorded when impulse was given to energy funds.

Interest rate impulses showed a positive impact on all gold funds leading to a raised NAV by the end of the 10th period. After initial null response, fund f_1, f_15, f_16, f_17, f_19, f_20, f_22, f_23, f_25 & f_26 showed very huge positive effect raising the NAVs. Energy funds, however, showed negligible fluctuation in NAVs.

An impulse in Sensex caused a negligible effect on all the gold funds while all the energy funds showed a negative effect. In f_27 & f_32 the effect was more pronounced.

An impulse in Nifty caused an immediate null effect on all the funds, but gradually a negative response set in for most of the funds finishing towards lower NAVs towards the end of the 10th period. Some gold funds like f_16, f_17, f_19, f_20, f_22, f_23, f_25 & f_26 showed no immediate effect, gradually showed declining NAVs and towards the end recovered a little settling down to less negative NAVs.

5.6. Variance Decomposition (Table 3)

On doing variance decomposition (Table 3) of funds NAVs, we see that none of the macroeconomic variables has an instantaneous effect. It is only own innovations that generate 100% variance in the 1st period. Effect of fund's own innovations starts decreasing over time and generates about 50% - 60% effect in all the funds till the end of the 10th period.

At the end of the 10th period, the gold funds showed an impact of around 20% - 25% when an innovation in interest rates was introduced. About 50% of the sample gold funds showed a marked impact of the impulse of foreign exchange reserves. Energy funds on an average showed a good response to a shock in money supply leading to 15% - 20% impact on NAVs. Though f_28 showed no change.

Rest all the macroeconomic impulses showed marginal diminishing effects on various funds.

6. Discussion of Results

The whole world is interconnected and no country's economy is isolated from that of another. If any change takes place anywhere its ripples are felt all over the globe be it terrorism, stock market crash or any political event. We saw how the changes in macroeconomic variables caused sudden changes in stock markets. Own fund information led to a high fluctuation in mutual fund NAV's, probably due to change in investor perception about the future profits and losses from the said fund. A good fund information would increase the investment in mutual funds, thus raising their NAV's while *vice versa* will happen when an unfavorable fund information pours in.

Table 3. Variance decomposition.

	Fund's own innovation	Innovation in M_1	Innovation in M_2	Innovation in M_3	Innovation in M_4	Innovation in M_5	Innovation in M_6	Innovation in M_7	Innovation in M_8	Innovation in M_9
f_1	47	2.5	1.3	2.7	2	1	8.7	32	0.5	1.6
f_2	60	3	0.3	0.7	1.4	0.7	2	25	1.6	5
f_3	65	2	0.5	1.7	0.7	0.5	6	20	1	4
f_4	56	0.7	1.3	3	0.5	0.8	11	26	0.2	0.6
f_5	61	1.3	0.1	0.9	1.7	0.5	4	24	1.4	5
f_6	60	1.6	0.5	0.6	1.8	0.8	2.9	23	1.9	8
f_7	44	1.7	0.6	0.4	2	2	23	21	1.5	3
f_8	68	3.6	0.2	0.6	0.5	0.4	4	16	2	4
f_9	57	1	1	1	3.5	0.7	2.7	26	1.3	4.7
f_10	56	0.9	1	1.3	4	1	4	24.7	1	5.7
f_11	57	1.7	0.6	1.5	3	0.7	3	25.5	1	5
f_12	65	1.8	0.4	2	6.5	0.8	13.5	3.7	1	5
f_13	70.6	2	1.8	8	6	0.5	7	1	0.1	2
f_14	62.5	0.3	0.3	1	5	2	2.3	20	1.4	5
f_15	42	1.8	0.6	0.4	2	2	25	20.8	1.6	3
f_16	43	1.7	0.6	0.4	2	2	25	20.6	1.5	3
f_17	50	1.3	1	1	5.3	1	9	28	1	2.5
f_18	54	3	1	0.7	0.8	2.3	10	27	0.3	0.8
f_19	43	1.8	0.6	0.4	2	2	25	20	1.5	3
f_20	43	1.8	0.5	0.4	2	2	24.6	20	1.6	3
f_21	42	1.7	0.6	0.4	2	2	25	21	1.6	3
f_22	43	1.8	0.6	o.4	2	2	24	20	1.5	3
f_23	44	1.6	0.5	1.6	1.3	2	15	30	0.9	2.8
f_24	43	1.8	0.6	0.4	2	2.3	25	21	1.5	3
f_25	43	1.7	0.6	0.4	2	2.2	24	21	1.6	3
f_26	43	1.8	0.6	0.4	2	2	24.3	21	1.5	3
f_27	42	5	11	7.8	0.3	11.8	1.6	1.7	15	3.7
f_28	83.6	5	0.1	10	1	0.3	2	1.5	5	0.5
f_29	43	9	18	2.5	2	12	2.7	1.4	6	3
f_30	50	3.5	3	11.6	0.8	16.6	0.1	1.7	5	8
f_31	38	3	6.3	12.4	2.4	23.8	0.7	2.5	3	7.5
f_32	46	2.7	1.4	11.9	0.6	12.4	0.8	1.6	17.9	4.8
f_33	53.6	11	5.8	1.8	2.4	12	0.9	1.3	2.5	8.5
f_34	45	7	3.5	6	0.2	12.7	0.8	1.6	13	10
f_35	32.5	13.4	1.6	6.3	0.3	15	0.4	1	9	20
f_36	26.8	7.8	6.7	10	0.6	21	2.2	0.7	2.7	22
f_37	51	7	2	16	0.2	12.6	0.8	0.2	2.3	7.8
f_38	42.5	5	2.3	17.8	0.4	19	0.2	2.2	6	4.7
f_39	50	3.8	9.3	9	1.5	10.7	0.7	1.8	1.7	11.5
f_40	44	7.5	5	7.6	0.1	15.8	0.6	0.6	4	14.4
f_41	56.7	7.8	2.8	2.6	1.5	15.8	0.2	0.7	5.4	6.5

Source: researcher's analysis [17] [18].

In case of interest rate changes, investors usually look for alternative investment avenues, where they expect profits. Hence, it was seen that when there was a change in interest rate, more investments and hence higher NAV's were reported in case of gold funds. Less effect was seen in case of energy funds, as probably investors perceive "gold" funds less volatile than "energy" funds. Energy sector as such has a trend of high fluctuation. It was also seen that as foreign exchange reserves changed, it led to changed (increased) investments in gold funds. The probable reason could be that whenever foreign exchange reserves change, there is a change in the strength of rupee. This instantly affects the investor psychology, who start looking for safe alternative investment avenues. Low degree of cointegration with all macroeconomic variables was reported when energy mutual funds were considered. This may be because these funds are a relatively new concept and investors have not developed high confidence in them. However, it was seen that whenever there was an increase in money supply, investors increased investments in energy funds, since probably they considered "energy funds" good investment avenues to park their extra savings.

USD exchange rate, crude oil price, silver price, gold price, Sensex and Nifty were seen to have a diminishing impact on most of the funds, the reason could be attributed to the already set in turbulent world economic situation since past many years now.

In such a situation the common investor is left at the mercy of stock markets. The rupee has been depreciating for some time now and the trend is almost constant. Crude oil remains one of the most important variables in the world economy even after its prices have fallen to all-time low by February 2016. The most important reason for this is that the "supply" of crude is limited and after the unrest in West Asian and Arabic world, the situation has worsened. The USA has been exporting oil but we know there is a limit to it, the crude formation in the USA is very deep inside and its drilling is a costly affair. Post-Chinese market crash last year, the demand for crude oil declined, which rendered it cheaper. Post Brexit it is predicted that crude and other commodity prices will slacken down. For India this is seen as a positive aspect since last time the crude oil prices crashed, inflation came under control. Also, since the investments abroad will get lesser, the common investor is believed to be switching over to assets like gold so as to play safe. Since physical gold is also prone to all these macroeconomic factors, the best option in this situation is to invest in portfolio of assets like in mutual funds.

Though the research presented here was done carefully taking all precautions, yet there are certain limitations and scope for further research. Only nine macroeconomic variables were chosen based on the frequency of data availability. Other variables that effect macroeconomy may be included, which have low data frequency, by expanding the time period of study. These factors can include GDP (gross domestic product), CPI (consumer price index), WPI (wholesale price index), IIP (index of industrial production), FDI (foreign direct invest-

ment), FII (foreign institutional investment), Per capita income etc. Funds other than energy and gold funds can also be investigated, which may include money market funds.

7. Conclusions

We accept Ho_3, Ho_5, and Ho_8 when we consider the case of gold funds as the gold price, money supply, and Sensex have an insignificant effect on gold funds in long run. But in short run money supply had a little negative impact. We reject Ho_1 and Ho_5 and accept all other hypothesis in case of energy funds since only money supply and USD exchange rate were found to have a profound impact both in long term and short term.

On the whole, it can be said that the various macroeconomic variables impact gold and energy mutual funds. The variables impact each other significantly thus leading to changes in the global supply, demand, and prices. The impulses start from the global and national stage and slowly penetrate deeply into the investment market. The common investor must be aware of this interplay so as to make a wise decision of investment. We have seen how some variables particularly impact gold funds and some variables particularly impact the energy funds. It may also be that when one category of fund is affected badly, the other may get an advantage and show a boost in their NAVs. Thus it is important to keep a track of all the macroeconomic happenings in the country and the world at large so as to avoid missing opportunities.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Ahmad, K.M., Ashraf, S. and Ahmed, S. (2005) Is the Indian Stock Market Integrated with the US and Japanese Markets? An Empirical Analysis. *South Asia Economic Journal*, **6**, 193-206. https://doi.org/10.1177/139156140500600202

[2] Gera, A. (2007) Macro-Economic Factors Affecting Mutual Funds in India & Basis for Evaluating Mutual Fund Performance. Alliance Business School.

[3] Dash, M. and Kumar, G.D. (2008) A Study on the Effect of Macroeconomic Variables on Indian Mutual Funds. http://ssrn.com/abstract=1316442

[4] Gupta, P.K. and Siddiqui, S. (2010) Weak Form of Market Efficiency: Evidences from Selected NSE Indices.

[5] Srivastava, A. (2010) Relevance of Macroeconomic Factors for the Indian Stock Market. *Decision*, **37**, 69-89.

[6] Shukla, S. (2011) Role of Macroeconomic Variables in Indian Mutual Fund Industry. *Analytique*, **7**, 4-13.

[7] Khalid, M. (2012) Long-Run Relationship between Macroeconomic Variables and Stock Return: Evidence from Karachi Stock Exchange (KSE). School of Doctoral Studies (European Union) Journal, 95-105.

[8] Patel, S. (2012) The Effect of Macroeconomic Determinants on the Performance of

the Indian Stock Market. *NMIMS Management Review*, **22**, 117-127.

[9] Joshi, M. (2013) Factors Affecting Indian Stock Market. *International Journal of Contemporary Research in Management, Engineering and Health Science*, **2**, 37-45. https://doi.org/10.2139/ssrn.2238539

[10] Singhania, M. and Anchalia, J. (2013) Volatility in Asian Stock Markets and Global Financial Crisis. *Journal of Advances in Management Research*, **10**, 333-351. https://doi.org/10.1108/JAMR-01-2013-0010

[11] Abdul, N.B. and Sarvani, K. (2014). Evaluating the Performance of Indian Mutual Funds Schemes: Macroeconomic Factors as Performance Indicators. In: 11*th Asian Business Research Conference*, BIAM Foundation, Dhaka. http://www.wbiworldconpro.com/pages/paper/dhaka-conference-2014/2318

[12] Kumar, R. and Gautam, S. (2014) An Empirical Study on Impact of FII and Other Stock Exchanges Volatility on BSE Stock Exchange Volatility'. *International Journal of Engineering Technology, Management and Applied Sciences*, **2**.

[13] Sanningammanavara, K.V., Kumar, K. and Rakesh, H.M. (2014) Macro-Economic Forces and Indian Stock Market: An Empirical Relation. *International Journal of Commerce*, *Business and Management*, **3**, 457-465.

[14] Singh, P. (2014) Indian Stock Market and Macroeconomic Factors in Current Scenario. *International Journal of Research in Business Management*, **2**, 43-54.

[15] Choudhary, N., Nair, G.K. and Purohit, H. (2015) Volatility in Copper Prices in India. *Annals of Financial Economics*, **10**, 1-26. https://doi.org/10.1142/S2010495215500086

[16] Mohanasundari, M. and Vidhyapriya, P. (2015) Indian Mutual Fund Industry: An Impact of Investor's Perception and Performance of Tax Saving Schemes in Mutual Fund. *International Business Management*, **9**, 267-272.

[17] Hair, J.F. and Anderson, R.E. (2006) Multivariate Data Analysis. 6th Edition, Pearson Education, New Delhi.

[18] Nargundkar, R. (2008) Marketing Research: Text and Cases. 3rd Edition, Tata McGraw Hill, New Delhi.

Appendix

Table A1. Coding.

Mutual Funds Code	
R*Shares Gold Etf Dividend (Nav)	F_1
Axis Gold Fund Rg (Nav)	F_2
Birla Sun Life Gold Fund Rg (Nav)	F_3
Canara Robeco Gold Savings Fund Rg (Nav)	F_4
Hdfc Gold Fund (Nav)	F_5
Icici Prudential Regular Gold Savings Fund Rg (Nav)	F_6
Idbi Gold Fund Rg (Nav)	F_7
Invesco India Gold Fund Rg (Nav)	F_8
Kotak Gold Fund G (Nav)	F_9
Reliance Gold Savings Fund G (Nav)	F_10
Sbi Gold Fund Rg (Nav)	F_11
Dsp Br World Gold Fund Regular G (Nav)	F_12
Kotak World Gold Fund Std. G (Nav)	F_13
Quantum Gold Saving Fund G (Nav)	F_14
Quantum Gold Fund Etf (Nav)	F_15
Axis Gold Etf (Nav)	F_16
Birla Sun Life Gold Etf (Nav)	F_17
Canara Gold Etf (Nav)	F_18
Gs Gold Bees (Nav)	F_19
Hdfc Gold Etf (Nav)	F_20
Icici Pru Gold Iwin Etf (Nav)	F_21
Idbi Gold Etf (Nav)	F_22
Invesco India Gold Etf (Nav)	F_23
Kotak Gold Etf (Nav)	F_24
Sbi Etf Gold (Nav)	F_25
Uti Gold Etf (Nav)	F_26
Uti Growth Sectors-Energy Fund G (Nav)	F_27
Dsp Br World Energy Fund Rg (Nav)	F_28
Dsp Black Rock Natural Resources And New Energy Fund Rp-G (Nav)	F_29
Reliance Diversified Power Sector Fund-G (Nav)	F_30
Escorts Power And Energy Fund Rg (Nav)	F_31
Sahara Power And Natural Resources G (Nav)	F_32
Sbi Infrastructure Fund Rg (Nav)	F_33
Sahara Infrastructure Fund Var Rg (Nav)	F_34
Canara Robeco Infrastructure Fund G (Nav)	F_35

Continued

Taurus Infrastructure Fund Rg (Nav)	F_36
Baroda Pioneer Infrastructure Fund G (Nav)	F_37
Escorts Infrastructure Fund G (Nav)	F_38
Idfc Infrastructure Fund Gr (Nav)	F_39
Icici Prudential Infrastructure Fund G (Nav)	F_40
Invesco India Infrastructure Fund Rg (Nav)	F_41
MACROECONOMIC VARIABLES	
Indian rupee spot exchange rate M_1	
Brent Crude Futures	M_2
Gold Spot	M_3
Silver Spot Price	M_4
India Money Supply M3 Yoy	M_5
Indian Foreign Exchange Reserves Usd	M_6
91 Day Treasury Bill Yield	M_7
Sensex	M_8
Nifty 50	M_9

Table A2. Coding groups.

Group	Members
Group 1	f_1, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 2	f_2, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 3	f_3, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 4	f_4, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 5	f_5, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 6	f_6, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 7	f_7, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 8	f_8, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 9	f_9, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 10	f_10, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 11	f_11, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 12	f_12, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 13	f_13, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 14	f_14, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 15	f_15, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 16	f_16, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 17	f_17, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 18	f_18, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 19	f_19, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9

Continued

Group 20	f_20, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 21	f_21, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 22	f_22, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 23	f_23, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 24	f_24, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 25	f_25, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 26	f_26, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 27	f_27, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 28	f_28, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 29	f_29, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 30	f_30, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 31	f_31, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 32	f_32, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 33	f_33, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 34	f_34, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 35	f_35, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 36	f_36, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 37	f_37, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 38	f_38, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 39	f_39, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 40	f_40, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9
Group 41	f_41, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9