

IMPACT OF MACROECONOMIC FACTORS ON STOCK PRICE: APPLICATION OF MLR

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Abstract - This research study is related with the dynamic interactions among stock market, inflation, crude oil, industrial growth, exchange rate with firm level oil stock price. Since the importance of all the macroeconomic factors are evident in theory must also be verified through the empirical analysis of data that gives rise to understand the scope of this research study. This study concludes that all the macroeconomic factors taken in this study are jointly affecting the oil stock price. The multiple linear regression model (MLR) for oil stock has been chosen based on the goodness of fit measures and avoids the problems of multicollinearity, auto correlation and heteroskedasticity. Results found that Nifty Index is highly significant having its full impact in determining the stock price.

Key words- Stock Price, MLR, Correlation, Macroeconomic Factor.

I. INTRODUCTION

The rising oil prices are concerned for both the investors and common man. Every time the rise in crude oil price in international markets causes a sudden increase in petrol and allied products. For the investors of stock market there is no profitable trading rule as per the theory of Efficient Market Hypothesis (EMH) therefore a thorough analysis of macroeconomic factors and their relationships gives some idea on the raising/falling stock prices at firm level. The performance of India's Oil & Gas industry is dependent on the international oil markets, therefore the rising crude prices in international markets causes much volatility in Oil stocks especially in the recession period. Moreover the consumption of oil gives rise to the growth in other sectors that necessitates studying the overall sensex movements, role of IIP, Inflation and the role of Exchange rates.

Each stock movement is the function of various economic factors, macro-economic and micro-economic. In this research study the factors that affect the oil and gas sector are studied. Stocks of the Oil and Gas companies are considered to be dominated by crude oil prices and other economic factors. The factors that the considered to be dominant in affecting the price of oil companies are given below:

1. Crude oil prices – Indian Crude Basket
2. Inflation Index (WPI)
3. Nifty Index
4. Index of Industrial Production (IIP)
5. Exchange Rate

There can be many factors that could affect the price of the stock and cannot say that the above factors are only responsible but they are considered to be more dominant than the other factors. The common factors

for all the stocks are; fundamentals of the company, economic and social environment, governmental policies and external environmental and these are also applicable to the stocks selected in this study. A brief description of these macroeconomic variables is given below to provide a basic understanding on the present research.

II. LITERATURE REVIEW

In the literature, various theoretical reasons have been explained the linking behavior of stock prices and key macro economic variables. Friedman (1988) suggests 'wealth effect and substitution effect' as the possible channels through which stock prices might directly affect money demands in the economy. Friedman (1988) expected that the wealth effect will dominate and thus the demand for money and stock prices to be positively related. The theoretical basis to examine the link between stock prices and the real variables are well established in economic literature, Baumol (1965) and Bosworth (1975). The relationship between stock prices and real consumption expenditures, for instance, is based on the life cycle theory, developed by Ando and Modigliani (1963), which states that individuals base their consumption decision on their expected life time wealth. Part of their wealth may be held in the form of stocks linking stock price changes to changes in consumption expenditure. Similarly, the relationship between stock prices and investment spending is based on the 'q' theory of James Tobin (1969), where q is the ratio of total market value of firms to the replacement cost of their existing capital stock at current prices. In the financial literature, much of the previous studies have pointed out that stock prices, real economic activity, and consumer price levels indicate strong long run equilibrium relationships (Adrangi, Chatrath and

Raffiee, 1999; Adrangi, Chatrath and Sanvicente, 2000). Hondroyiannis and Papapetrou (2001) results showed the opposite. They find that there is no long-run relationship among these economic variables during the period study in the Greece stock market. As for relationship between stock returns and inflation per se, many find evidence that stock returns are negatively affected by both expected and unexpected inflation particularly in US (Lintner 1975; Fama and Schwert 1977; Fama 1981, 1982; Geske and Roll (1983). Fama (1981), for instant, offer an explanation for the negative relationship between stock returns and inflation through a hypothesized chain based on the money and the quantity theory of money. Chen, Roll, and Ross (1986), Bodie (1976), Fama (1981), Geske and Roll (1983), Pearce and Roley (1983), Pearce (1985) have tried to show empirical associations between macroeconomic variables and security returns. Bodie (1976), Fama (1981), Geske and Roll (1983), and Pearce and Roley [1983], Pearce [1985] projected a negative impact of inflation and money growth on equity values. Chen et al (1986) and Fama (1990) have shown that the real economic activity, interest rate and stock returns were correlated. However, most of these earlier studies focus upon the short-run relationship between stock market and financial and macro-economic variables, which may remove important information contained in the permanent component of economic activity concerning the evolution of short-run movements.

The widely popular CAPM has been severely challenged since returns can be predicted from other financial factors. This has led to the development and testing of various alternative asset pricing specifications, such as the Arbitrage Pricing Theory (APT) and Present Value Model (PVM). Varying evidences of causal links of stock returns and macro variables have been found in the literature using various asset pricing specifications. In the context of macro dynamics of stock returns, APT assumes that returns are generated by a number of macroeconomic factors. It allows multiple risk factors to explain asset returns. Chen, Roll and Ross (1986) have argued that stock returns should be affected by any factor that influences future cash flows or the discount rate of those cash flows. In an empirical investigation they found that the yield spread between long and short term government bonds, expected inflation, unexpected inflation, nominal industrial production growth and the yield spread between corporate high and low grade bonds significantly explain stock market returns. The advantage of the PVM model is that it can be used to focus on the long run relationship between the stock market and macroeconomic variables. In PVM model all macroeconomic factors that influence future expected cash flows or the discount rate by which the cash flows are discounted should have an influence on the stock price. The long-run relationship between stock

market and the economic variables had received little attention of researchers except in Mukherjee, Naka, (1995), Chung & Ng (1998), Maysami and Koh (2000) and Nasseh and Strauss (2000). By using the concept of co integration, first introduced by Engle and Granger (1987), used to investigate the empirical long run relationships between stock market indices and both measures of economic activity and financial variables. Co-integration between stock prices and economic activity can be seen to be consistent with both internal & theoretical consumption and production-based asset pricing models. These models suggest that stock prices are related to expect future production through effect on the discounted value of changes in cash flows and dividends (Cochrane).

A relatively early application of the VAR model to the analysis of the relationship between the stock prices and the macro economy is by Lee (1992) and Cheung and Ng (1998). While the VAR analysis is useful for the simulation of the effects on the endogenous variables of shocks to equation error terms, the non-theoretical nature of such models makes the interpretation of these shocks difficult. Recently several researchers like Baestaens et. al. (1995), Kaastra Ibeling and others (1996), Katsurelis (1998), Kamath (1999 and 2002) recommend the use of Artificial Neural Network (ANN) for investigating the co integrating relationship as well as forecasting in capital markets.

III. DATA & METHODOLOGY

With the aim of understanding the determinants of oil company stock price variations, in this research study monthly time series data is used covering the period from January 2010 to September 2016 on selected macroeconomic variables and oil company stock prices. The variables covered under study are:

1. Price of crude oil (India Crude Basket)
2. Nifty Index
3. Index of Industrial Production
4. Wholesale price Index
5. Exchange Rate

& Average Monthly Price of ONGC Stock.

In this research study exploratory cum causal design is used to determine the effect of macroeconomic determinants of oil stock prices, the cause and effect relationship between stock price and other macro economic factors. This exploratory research framework includes a wide literature review of past and recent past research studies in this area of work from around the world. Experience surveys are used in consultation with stock broking companies to obtain their views and perceptions on the subject in real time.

All the data variables are scale variables and are converted into log form to reduce the scale impact and possible heteroskedasticity impact in MLR model results.

- Descriptive Statistics
- Karlpearson’s coefficient of correlation
- Multiple Linear Regression Model

- Exchange Rate

Descriptive Statistics are the univariate summary statistics for the data variables that includes sample size, mean, minimum, maximum, standard deviation, variance, range, sum, standard error of the mean, and kurtosis and skewness with their standard errors. These statistics are helpful in understanding central tendency and dispersion in the data variables. The higher the standard error the less is the consistency in the performance of data variables.

The Karlpearson’s coefficient of correlation (r) measures the magnitude of linear relationship between two variables. The value of “r” may take from -1 to +1, indicating that the variables perfectly negatively correlated and perfectly positively correlated respectively. Depending on the value of “r” the correlation between the variables are studied, if the value of “r” lies between 0 to 0.5 then the variables are said to have low positive relationship, if the value of “r” lies between 0.5 to 0.75 then the variables are said to have moderately positive relationship and if the value of “r” lies between 0.75 to +1 then the variables are said to be highly positively correlated, similar the case in negative relationships.

Multiple linear regression model, which consists of one dependent variable and more than one independent variable are applicable for the data variables which have linear relationship among them. The term “regression” literally means stepping back towards the average. In multiple linear regression the average relationship between the variables is used estimate the dependent variable for the given independent variables. The dependent variable (effect) is called as the study variable and the independent variables (cause) as auxiliary information. The assumption of linearity drives the regression model for estimation and forecasting the dependent variable understudy.

In this research study the independent variables are:

- Price of crude oil
- Nifty Index
- Index of Industrial Productivity
- Inflation Index.

The dependent variable is the price of oil stock. Step wise linear regression method is used to identify the significant variables in the study.

The general equation of a multiple linear regression is as follows

$$Y = A + B1X1 + B2X2 + \dots + BnXn + U$$

Where Y is dependent variable, the value of which is to be known. X1, X2,....., Xn are independent variable whose values are known. B1, B2, B3, ,Bn are the coefficient of X1, X2, X3, ,Xn respectively. A is constant. U is the error term.

IV. RESULTS AND DISCUSSION

ONGC stock treated as dependent variable, selected macroeconomic factors as independent variables four linear regression models are fitted by using the stepwise linear regression procedure. In stepwise linear regression at each step an independent variable is added to the model until the model fit is good, the selected model is then tested for validation, and then the model implementation in terms of forecasting can be done.

$$1_ONGC = -4.77844 + (1.00293 * 1_NIFTY) + (1_EXCH * 0.861264)$$

In above regression model of ONGC stock, inflation rate and exchange rates are the most significant factors affecting the stock price. On the average 1% increase in Nifty index will increase the ONGC share price by about 1%. Nifty index is significantly affecting the ONGC stock price. Similarly on the average 1% increase in exchange rate will increase the ONGC share price by about 0.86%. Crude price, inflation rate and IIP has no much impact on share price ANOVA table significant value clearly indicates that the model is fitted well with the predictors. The R-squared value 0.857439 indicates that about 85% of variations in ONGC stock price are explained by the predictor’s Nifty index, exchange rate. As the model fit measures R-squared and Adjusted R-squared values are one and the same concludes that the model is best fit. ONGC stock Regression Model:

Model 1: OLS, using observations 2007:01-2009:09 (T = 33)					
➤ Dependent variable: 1_ONGC					
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	-4.77844	1.38306	-3.4550	0.00166	***
1_NIFTY	1.00293	0.0862917	11.6226	<0.00001	***
1_EXCHR	0.861264	0.200559	4.2943	0.00017	***
R-squared		0.857439	Adjusted R-squared		0.847935
F(2, 30)		90.21814	P-value(F)		2.04e-13
Rho		0.186806	Durbin-Watson		1.623876

Table1 : ONGC stock Regression Results

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	.706	2	.353	78.478	.000
Residual	.130	29	.004		
Total	.837	31			

Table 2: ANOVA
Predictors: (Constant), LNNIFTY, LNECHR Dependent Variable: LNONGC

CONCLUSION

It is commonly felt that for investing in stock market there is no profitable trading rule for the investor to choose, however the basic fundamental and technical analysis of the stocks helps the investor to understand the rise and fall of stock prices. This is more relevant for oil stocks, as the commodity oil impacts the performance of the other sectors as engine for growth, dependent on crude price of international markets.

This study concludes that all the macroeconomic factors taken in this study are jointly affecting the oil stock price. Results found that Nifty Index is highly significant with all oil stock having its full impact in determining the stock price. ONGC stock is impacted by the Exchange rate significantly. Industry growth rate and Inflation rate have no much individual impact on the oil stock prices but when they studied jointly with Crude price and Nifty Index then they also contribute to the change of price discovery in oil stock. Investors should be very cautious, it is advisable to see the overall index movement and Indian crude basket prices instead of going for speculation and other unfavorable tips.

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