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Impact of Macroeconomic Variables on Stock Market Volatility

Akshay Hegde[1], Dr. Batani Raghavendra Rao[2]

Guidance: Dr. Batani Raghavendra Rao
CMS Business School , Jain University

1. INTRODUCTION:

The movement of stock indices is quite responsive to shifts in both the economic fundamentals and the expectations for the future. Expectations are shaped by a variety of subjective, unpredictable, and non-quantifiable factors in addition to the micro and macro fundamentals, which can be generated either rationally or adaptively on the basis of economic fundamentals. It is believed that domestic economic fundamentals influence how well the stock market performs. However, domestic economic factors are also susceptible to change in the globally connected economy because of policies that have been implemented or are anticipated to be adopted by other nations, as well as because of certain global occurrences. The interest rate, exchange rate, and stock prices in the global economy are the common external factors that affect stock returns. For example, changes in interest rates by major global economies also influence capital inflows and outflows, rather than only the domestic interest rate. The depreciation of currency in India as a result of increased foreign exchange inflows is a prime example. Major export-oriented enterprises' stock prices have decreased due to the increase of the rupee. The textile and information technology sectors are two instances of declining stock values brought on by the rupee's rise.

In India, several steps have been done towards economic liberalisation since the early 1990s. Simultaneously, numerous measures have been implemented to fortify the stock market, including the accessibility of stock markets to global investors, the regulatory authority of SEBI, the trading of derivatives, and more. The size and depth of the Indian stock markets have significantly improved as a result of these actions, and they are now starting to fulfil their rightful place. Many international entities currently closely monitor and analyse movements in the Indian stock market. For traders, investors, and policy makers, it may be helpful to understand the macro dynamics of the Indian stock market. The findings may indicate whether changes in stock prices are the result of other factors or whether they are one of the factors influencing changes in other macroeconomic aspects of the economy. Additionally, the study plans to investigate if changes in the stock market are related to the financial sector, the real sector, or both.

We examine the long-term correlation between the BSE and a few key macroeconomic factors. We examine the link between these components using the regression equation model (Galton, 1877). The empirical data show a strong correlation between the exchange rate and gold prices, which has a significant impact on stock prices. In contrast, the effects of foreign exchange reserves and inflation on stock prices is only slightly significant.

2. OBJECTIVES OF THE STUDY:

The following goals are the focus of this paper:

1. To investigate the principal macroeconomic factors.
2. To investigate how these macroeconomic factors affect stock price.
3. To investigate whether there is a relationship of any kind between macroeconomic factors and stock price.

3. REVIEW OF LITERATURE:

The following are the contributions of this paper. This paper offers the first attempt to examine the state of the stock market close to the elections by, first, adopting a study period that goes beyond January 2008. Studies that have already been done on the time series behaviour of BSE do not include the post-election era. In 1990, Naka utilised a vector error correction model (VECM) as described by Johansen (1991) to examine the cointegration of five different equations in the system. examined the positive correlation between output growth and stock prices and the negative association between interest rates or inflation and stock prices. Sharma (2008) evaluates the BSE's weak type of efficiency. Bhattacharya (2001) employed unit-root tests, cointegration, and the recently developed long-run Granger non-causality test by Toda and Yamamoto (1995)

They discovered that: (i) stock prices and the money supply, stock prices and national income, and stock prices and interest rates are not causally related; (ii) the index of industrial production is a strong predictor of stock price; and (iii) there is a two-way causal relationship between stock price and inflation rate. Mishra (2004) investigated the relationship between the stock market and foreign exchange markets using monthly data for the years 1992 to 2002. The study used the Granger causality test and the Vector Auto Regression technique, which revealed that there is no Granger causality between the return on the exchange rate and the stock return.

In an attempt to understand the relationship between realeconomic variables and the capital market in the Indian context, Ray (1993) used contemporary non-linear techniques like VAR and Artificial Neural Networks. The researcher discovered that while some variables had very little influence on the stock market during the studied period, others, such as the interest rate, output, money supply, inflation rate, and exchange rate, had a

significant impact. Abdalla (1996) examines how stock prices and currency rates interact in the developing financial markets of the Philippines, Korea, India, and Pakistan. With the exception of the Philippines, all sample countries' Granger causality test results indicate unidirectional correlation between exchange rates and stock prices. A different explanation for the relationship between stock prices and exchange rates, as proposed by Dornbusch (1980), can be given using portfolio balance techniques that emphasise the importance of capital account transactions. He discovered that an increase or decrease in stock values would cause the exchange rate to appreciate.

By using the discounted cash flow or present value model (PVM), the researcher tries to relate the stock price to future expected cash flows and the future discount rate of the cash flows. Chen (1986) has argued that any factor that influences future cash flows or the discount rate of those cash flows should affect stock returns. Once more, the stock price should be impacted by any macroeconomic factors that affect projected future cash flows or the discount rate used to calculate those cash flows. According to Sangeeta Chakravarty, there is no correlation between currency rates and stock prices. Likewise, there is no correlation between the price of gold and the price of stocks.

Sahid Ahmed (2008) with statistics from quarters. While BVAR modelling for variance decomposition and impulse response functions has been used to analyse short-term relationships, Johansen's approach of cointegration and the Toda and Yamamoto Granger causality test have been utilised to explore long-term links. According to the study, changes in stock prices are not just a result of how important macroeconomic variables behave, but they also contribute to changes in other macroeconomic variables.

According to Mukherjee (1995) and Bernanke (2005), changes in the money supply can provide information about changes in money demand, which is a result of expectations for future output. Agrawalla (2005) calculated the cointegration of the macroeconomic variables and the share price index using the vector error correction model (VECM). Using VAR analysis, Hondroyiannis (2001) looks at whether changes in economic activity indicators have an impact on the Greek stock market's performance. The study's main conclusions are that the performance of the domestic stock market is influenced by economic activity in the home market.

The lead and lag correlations between the Malaysian stock market and five important macroeconomic variables are determined by Habibullah et al. (2000). The long-term equilibrium link between a few macroeconomic variables and the index of the Bombay Stock Exchange is examined by Naka (2001). According to the study's findings, domestic output growth is the main factor driving the Indian stock market's success, with domestic inflation acting as the biggest hindrance. Pethe (2000) demonstrates weak causation from IIP to share price index (Sensex and Nifty) but not the other way around, using Indian data from April 1992 to December 1997.

Bhattacharya (2002) examines the nature of the causal relationship in India's overseas sector between stock prices and macroeconomic variables. Using unit-root tests, cointegration, and the recently introduced long-run Granger non-causality test by Toda and Yamamoto (1995), it is determined that there is no causal relationship between the variables and stock prices.In his investigation of the nature of the causal relationships that exist in India between stock returns, net foreign institutional investment (FII), and exchange rates, Basabi (2006) discovers that: (a) there is a bi-directional causal relationship between stock returns and FIIs; (b) at the 10% level of significance, there is a unidirectional causal relationship that runs from changes in the exchange rate to stock returns, not the other way around; and (c) there is no causal relationship between the exchange rate and net investment by FIIs.

Horobet Livia (2007) investigates the relationship between stock market prices and exchange rates as it relates to Romania, a newly admitted member of the European Union in January 2007 and one of the developing countries in Central and Eastern Europe. Standard and modified Granger causality tests, as well as standard bivariate cointegration tests employing the Engle-Granger and Johansen-Juselius methodologies, are used in the study. The analysis covered the months of January 1999 through June 2007, as well as two shorter timeframes (January 1999 through October 2004 and November 2004 through June 2007) to account for changes in the Romanian foreign currency market that happened following the end of 2004.The use of the Johansen-Juselius approach suggests the existence of cointegration between the two stock market indices and the exchange rates, but the results show no cointegration between the exchange rates and the stock prices.

Upon conducting a standard Granger causality test on non-cointegrated variables, one bilateral causality relationship was found between the stock prices and the bilateral exchange rate against the US dollar for the first sub-period, and one unilateral causality relation was found between the stock prices and exchange rates for the entire period and the second sub-period. Mazharul H. Kazi (2008) preserved the fundamentals of asset pricing theory while reviewing current developments in the analysis of the relationship between the movement of the security market and a priori variables. He employed the cointegration approach, which makes it possible to analyse the long-term link between security market prices and a priori variables, or macroeconomic variables, which are thought of as a stand-in for systematic risk factors.

Mookerjee and Yu (1997) examine the pricing mechanism of the Singapore stock market by examining potential long-term correlations between macroeconomic factors and stock market pricing. They discover that there is a cointegration between stock market prices and three of the four macroeconomic variables. Nasseh (2000) examined the long-term connections between stock market prices (as measured by pertinent share price indices) and both local and global economic activity across six nations: the UK, France, Germany, Italy, the Netherlands, Switzerland, and the Netherlands. and discover that while economic fundamentals can account for stock prices in the short and medium term, the long-term underlying volatility of stock prices is linked to macroeconomic fluctuations.

Cheah Lee Hen 3 (2006) examines the feedback-causal link between stock prices and each currency exchange and derivative product using the Kalman filter and several ARCH type models. researchers have studied and applied the Kalman filter technique extensively since its creation by Kalman and Bucy in the 1960s, and discovered that the Malaysian stock market shows no signs of a risk-return trade-off. Kandir (2008) looks into how macroeconomic variables affect Turkish stock returns. For the months of July 1997 through June 2005, a macroeconomic factor model is used.According to empirical research, the world market return, interest rate, and exchange rate appear to have an impact on all of the portfolio returns, however the inflation rate is only important for three of the twelve portfolios.

4. RESEARCH METHODOLOGY:

The four main macroeconomic indicators that are the subject of this study are the price of gold, foreign exchange reserves, exchange rate, and inflation. We research how these factors affect stock prices. The choice of these variables for study was influenced by a number of factors, including the fact that

the economy was heading into recession, which meant that the exchange rate would fluctuate frequently. At the same time, the value of gold was increasing and the value of the dollar was declining because of their inverse relationship, and inflation was also causing significant disruptions. For these reasons, our study is focused on these important economic variables. The study provides a brief overview of macroeconomic variables, and following a thorough investigation, we concluded that the macro variables in question had a significant impact on the economy. We attempt to determine the relationship between BSE prices, which act as dependent factors, and macro variables, which act as independent variables, utilising these variables. In order to do this, we consider the stock values from January 2008 to January 2009. The foreign exchange reserve inflation rate, gold price, and exchange rate change are the macroeconomic variables that were used in this study. To determine the impact of macroeconomic conditions on stocks, a multiple regression model is utilised.

Weekly data covering the period from January 2008 to January 2009 is used for the analysis. Two sub-groups of the study's data are included. Stock data (BSE Sensex) makes up the first data set. The second set of data includes macroeconomic variables such the foreign exchange reserve, inflation rate, exchange rate, and gold price. Only secondary data are used in this investigation. Data on exchange rates is gathered from statistical releases issued by the Federal Reserve. Data on foreign exchange reserves and inflation are sourced from the Reserve Bank of India. The price of gold is sourced from BSE and NASDAQ. The Bombay Stock Exchange and The Money Control provide stock returns. A statistical method that simultaneously establishes a mathematical connection between one or more independent variables and one dependent variable With four independent variables the prediction of Y is expressed by the following equation:

Y'i = b0 + b1X1i + b2X2i + b3X3i + b4X4i

The "b" values are called regression weights and are computed in a way that minimizesthe sum of squared deviation

$$\sum_{i-1}^{N}(Y_i - Y'_i)^2$$

Y'i = is the return on the stock portfolio i,
X1i = is the change in whole sale price
X2i = is the change in exchange rate,
X3i = is the change in foreign exchange reserve
X4i = is the change in gold price

5. CAUSAL RELATIONSHIP BETWEEN THE MACROECONOMICVARIABLES AND STOCK PRICES:

Regression analysis is used to assist us comprehend the observation, with stock prices acting as the dependent variable and macroeconomic variables acting as the independent variables.

Table 1
Descriptive Statistic

Descriptive Statistics

	Mean	Std. Deviation	N
Stock Price	13892.4336	3428.08609	55
Inflation Rate	8.4338	2.99887	55
Exchange Rate	43.9260	3.72590	55
Foreign exchange Reserve	285817.25	24888.775	55
Gold Price	870.3231	65.84736	55

The high standard deviation of stock prices is demonstrated by Figure 1. It represents the stock price's notable volatility. The data indicates that there is moderate fluctuation in the inflation rate, with a mean inflation rate of 8.4338 and a standard deviation of 2.99887. The standard deviation is 3.72590

while the mean exchange rate is 43.9260. Therefore, the exchange rate's variability is not that great. The standard deviation is 248888.775, and the mean of the foreign exchange reserve is 285817.25. It demonstrates that the foreign exchange reserve is somewhat variable. The gold price has a mean of 870.3231 and a standard deviation of 65.84736.The price of gold is highly variable yet still moderate.

Table 2

Correlations Matrix

Correlations

		Stock Price	Inflation Rate	Exchange Rate	Foreign exchange Reserve	Gold Price
Pearson Correlation	Stock Price	1.000	-.189	-.943	.754	.555
	Inflation Rate	-.189	1.000	.180	.294	-.224
	Exchange Rate	-.943	.180	1.000	-.817	-.677
	Foreign exchange Reserve	.754	.294	-.817	1.000	.653
	Gold Price	.555	-.224	-.677	.653	1.000
Sig. (1-tailed)	Stock Price	.	.083	.000	.000	.000
	Inflation Rate	.083	.	.094	.015	.050
	Exchange Rate	.000	.094	.	.000	.000
	Foreign exchange Reserve	.000	.015	.000	.	.000
	Gold Price	.000	.050	.000	.000	.
N	Stock Price	55	55	55	55	55
	Inflation Rate	55	55	55	55	55
	Exchange Rate	55	55	55	55	55
	Foreign exchange Reserve	55	55	55	55	55
	Gold Price	55	55	55	55	55

Table 2 displays the relationship between the price of gold, the foreign exchange reserve, and the inflation rate and stock price. The exchange rate correlation with stock price is -.943, indicating a strong negative association. The relatively low negative correlation between inflation and stock price is indicated by the inflation rate correlation of -.189. The stock price is not affected by this variable. The correlation between foreign exchange reserve and stock price is positive, with a value of.754. The correlation between the gold price and stock price is.555, suggesting a moderate relationship between the two.

The correlation between the exchange rate and inflation rate is less than one, but it is still very positive to the tune of.094.The foreign exchange reserve and inflation rate have a very weak, positive relationship that is only.015 in magnitude. Up to.05., there is a somewhat positive correlation between the inflation rate and the price of gold. The foreign exchange reserve and the exchange rate are unrelated. The foreign exchange reserve and exchange rate have a.0 relationship. Likewise, there is no connection between the price of gold and the exchange rate. The foreign exchange reserve and gold price have no relationship.

Table 3

Variables entered

Variables Entered/Removed			
Model	Variables Entered	Variables Removed	Method
1	Exchange Rate	.	Forward (Criterion: Probability-of-F-to-enter <= .050)
2	Gold Price	.	Forward (Criterion: Probability-of-F-to-enter <= .050)
a. Dependent Variable: Stock Price			

As in Table 3, multiple regression analysis accepts two variables i.e. Exchange rate andgold price which has effect on stock price.

Table 4

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.943[a]	.889	.887	1153.91790	.889	423.593	1	53	.000	.488
2	.950[b]	.902	.898	1095.47475	.013	6.806	1	52	.012	.

a. Predictors: (Constant), Exchange Rate

b. Predictors: (Constant), Exchange Rate, Gold Price

c. Dependent Variable: Stock Price

A statistic called 4R2 can provide some insight into a model's goodness of fit. A statistical indicator of how closely the regression line resembles the actual data points in regression is the R2 coefficient of determination. A regression line that fits the data precisely is indicated by an R2 of 1.0.R2 has a range of 0 to 1. Exchange rate coefficient of correlation in model 1 is 0.943.It demonstrates the extremely strong positive relationship between exchange rates and stock prices. R2 demonstrates a relationship between the stock price and the 88.9% exchange rate. Exchange rates have a big effect on stock prices. The coefficient of correlation (R) in model 2 is.950, suggesting a strong positive correlation between the price of gold and stocks. R2 stands at 90.2%.

According to model 2's results, the price of gold affects stock prices by 90.2%.The price of gold, the exchange rate, and stock prices are all significantly correlated.

A modification of R2 that accounts for the quantity of explanatory words in a model is called adjusted R2 (also written as). In contrast to R2, the adjusted R2 only rises when the addition of the additional term enhances the model beyond what would be predicted by chance. The modified R2 is always less than or equal to R2, and it can even be negative. The first model's adjusted R square is.887, which is lower than R square.The adjusted R square for model 2 is.902, which is lower than R square.

Table 5

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.640E8	1	5.640E8	423.593	.000[a]
	Residual	7.057E7	53	1331526.522		
	Total	6.346E8	54			
2	Regression	5.722E8	2	2.861E8	238.401	.000[b]
	Residual	6.240E7	52	1200064.938		
	Total	6.346E8	54			

a. Predictors: (Constant), Exchange Rate

b. Predictors: (Constant), Exchange Rate, Gold Price

c. Dependent Variable: Stock Price

The ANOVA table looks at how the controlled independent variables' effects differ in the mean value of the dependent variable, or stock price. The exchange rate and stock price have a considerable relationship, according to the results. as the value in the table is less than the calculated value of F. Model 2 demonstrates that the dependent and independent variables have a substantial relationship. Gold prices are significantly impacted by exchange rates and gold prices.

6. CONCLUSION:

Finding the lead and lag correlations between the stock price and macroeconomic indicators is the study's primary goal. Numerous researches have discovered a connection between macroeconomic factors and profits in equities markets. For developed nations (Chen, Roll and Ross (1986), Chen (1991), Clare and Thomas (1994), Mukherjee and Naka (1995), Gjerde and Saettem (1999), Flannery and Protopapadakis (2002)), as well as East Asia (Bailey and Chung (1996), Mookerjee and Yu (1997), Kwon and Shin (1999), Ibrahim and Aziz (2003)), the relationship between stock returns and macroeconomic factors is well-documented. Additionally, cross-national investigations have been conducted (Cheung and Ng, 1998; Wongbangpo and Sharma, 2002). The findings of these investigations disagree.Depending on the macroeconomic conditions employed, the findings of earlier research have altered. This research adds to the body of literature by examining the consequences of macroeconomic variables.

In this study, the impacts of macroeconomic conditions on stock price are tested during the period of January 2008 to January 2009 using a multiple regression model.The foreign exchange reserve, inflation rate, gold price, and change in exchange rates are the macroeconomic variables that were considered in this study. The macroeconomic variables are employed as the independent variables in regression models, and stock prices are used as dependent variables. The entire BSE Stockprice is impacted by the gold price and exchange rate, according to empirical results. The correlation between the exchange rate and stock price is 88.9%, while the correlation between the gold price and stock price is 90.2%. With the exception of the foreign exchange reserve and inflation rate, independent variables and stock price are significantly correlated. The null hypothesis is disproven. While the inflation rate is important for only three of the twelve portfolios, the exchange rate and gold price appear to have an impact on the total stock price. However, it doesn't seem that the price of gold or the pace of inflation have a big impact on stock returns. The null hypothesis holds. This indicates that the foreign exchange reserve and inflation rate have no bearing on the price of stocks.

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