RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND STOCK MARKET INDICES: A SECTOR BASED STUDY

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Abstract:

The study aims to discover the dynamic effect of selected Macroeconomic variables on some of the sector based indices of Nifty from 2009 to 2014. Few Econometric models are used to find the relationship between Exchange rate, Interest rate and Inflation on Automobile and IT sector stock indices. Unit root test, Regression analysis, Johenson's co-integration and Granger Causality tests are used for finding the relation between the selected variables. Results confirm the existence of a co-integration relationship between the considered variables. The estimates of the Granger Causality shows a unidirectional causal relation from Exchange rate to stock price (CNXAUTO) and from Interest rate to Inflation. It is also evident that a unidirectional relationship also exists from Exchange rate to Stock price (CNXIT), Stock price (CNXIT) to Inflation. The results of the study have implications on domestic investors, foreign investors, policy makers, and stock market regulators.

Key words: *Stock prices, Macroeconomic variables, Co-integration, Granger Causality*

INTRODUCTION

Financial Markets plan an essential role in establishing a balanced and efficient financial system of a countries economy. Various internal and external factors affects the working of the stock markets directly and indirectly. The link between the macroeconomic variables and the stock markets are well evidenced in the literature. This study extends the present literature in Indian context. This study considers three Macroeconomic variables like Exchange rate, Interest rate and Inflation and two sectorial indices of NSE stock market namely CNXAUTO and CNXIT (Patel, 2012)

Literature that investigates the link between Exchange rate and Stock prices is not conclusive. There exists two major theories related to financial markets. The first approach concludes that exchange rates should lead to Stock prices (TABAK, 2006). Exchange rate fluctuations that affect the value of the firm through changes in competitiveness and changes in the firm's assets and liabilities in foreign currency, eventually affecting firm's profits and the value of equity showing a positive effect. Contrarily, changes in stock prices may affect the movements in Exchange rate through portfolio adjustments (inflow/outflow of foreign capital) (Phylaktis & Ravazzolo, 2005). If there were a persistent upward trend in stock price, inflows of foreign capital would increase. A decrease in stock price would cause a reduction in domestic investor's wealth leading to a fall in the demand for money and lower Interest rates, causing capital outflows that would result in currency depreciation. Therefore under this approach, stock prices would lead Exchange rates with a negative correlation (Fama, 1970).

One of the major macroeconomic variable that is directly linked to economic growth is Interest rate. Interest rate is generally considered as the cost of capital, meaning the price or amount of fee paid for using others money for a certain period of time. Interest rate is the cost of borrowing money from a borrower's perspective and a fee charged for lending money from a lenders perspective. Efficient investors always look for an efficient market to invest their funds effectively. Few people would be able to make extraordinary profits in an inefficient markets which leads to loss of confidence in general public. In the event of an

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increase in the interest rate, investors would like to switch their investments from stock markets to bank deposits which would lead to a decrease in the demand for shares and decrease in share prices and vice versa. On the other hand, with the increase in the interest rate, interest paid by the banks to the depositors would also increase leading to the decrease in the investments in the economy which is another reason for decrease in share prices and vice versa. We can see an inverse or negative relationship between share prices and Interest rates.

Inflation has a positive relation with stock prices. Money supply and Inflation have a dual effect on stock returns. An increase in Money supply will lead to an increase in Inflation rate which increases expected rate of return. High expected return will decrease the value of the firm and results in lower stock prices. Secondly, increase in the inflation and money supply increases future cash flows, which in turn increases expected dividend and will increase stock prices. So there arises a need to find out the relation between Inflation and Stock prices (Patel, 2012).

REVIEW OF LITERATURE

Muktadir-al-Mukit, 2012, examine the impact of interest rates and exchange rate on stock index in Dhaka. He uses monthly time series data to investigate the effect of these variables for the period 1997 to 2010. Modern econometric techniques are used to know the short and long run relationship between the variables using co-integration and Error correction model, and analysis of variance decomposition. Granger casualty test has been used to calculate the causal relationship between the variables. With the aid of co-integration technique it is noticed that in the long run, a one percent increase in interest rate and exchange rate there is a 1.71% decrease and 1.04% increase in market index correspondingly. Estimated error correction coefficient proves 7.8 % deviation of stock returns are corrected in the short run. The existence of the unidirectional causality from market index to exchange rates and from interest rates to market index is suggested by the Granger causality analysis.

Pallegedara, 2012, examines the dynamic relationships between stock market performance and the interest rates in Sri Lanka during June 2004 to April 2011. We use all share price index in the Colombo stock exchange as a measure of stock market performance indicator and Sri Lanka interbank offer rate as a measure of interest rate. We employ some conventional time series econometric techniques namely Unit root test, cointegration test, vector auto correction model (VECM), Granger-Causality test and Impulse response functions (IRF) to trace out the relationships between stock market index and interest rate. The findings of interest include stock market performance is negatively associated with interest rate in the long run while no causal relationship is found in the short run.

Maysami, Howe, & Hamzah, 2004, have performed a cointegration analysis towards some macroeconomic variables and the stock market indices of Singapore. They study showed that Singapore's stock market form cointegrating relationships with changes of interest rate, exchange rate, industrial production, price levels and money supply both in the long-run and short-run. The same empirical results were found by Bhattacharya and Mukherjee (2001). They have performed similar test using unit-root test, cointegrationand Granger causality test between the stock market index BSE Sensitive Index and exchange rate, foreign exchange reserves and value of trade balance in India. Their study showed no causal linkage between the BSD Sensitive Index, interest rate and exchange rate.

Chong and Tan (2007) applied Kwaiatkowski Philips, Shmidt and Shin (KPSS)

cointergration test on the macroeconomic factors against the volatility of exchange rate on 4 countries, Malaysia, Indonesia, Thailand and Singapore. Their study showed that the macroeconomic factors which are interest rate, money supply, consumer price index, trade balance and composite indices move in the same direction with exchange rate in the long run.

Adam & Tweneboah, 2008, observes that there exists a long run co-integration relationship between the macroeconomic variables and the stock index of Ghana by using quarterly data from 1991 to 2007 using co-integration and VECM model. The Vector Error Correction Model (VECM) analysis proves that the lagged values of inflation and interest rate has influences stock prices. The exchange rate, inward foreign direct investments and the oil prices has a weak impact on the price changes.

Kyereboah-Coleman, F, & Agyire-Tettey, 2008, contrarily proved that lending rates of bank has a negative impact on the performance of stock prices in Ghana which in turn hamper growth of business.

Bekhet & Matar, 2013, examined the short run and long run symmetric relation between the macro economic variables and the stock market index in Jordan. Annual time series data of macro-economic variables (Money supply, Industrial production, Exchange rate, and discount rate) were used. Time frame of the study was from 1978 to 2010. He used the ADF, bound testing approach, CUSUM, and CUSUMQ tests to test the stationary of data and co-integration among the variables. They found there was a long run relationship between the examined macroeconomic variables and the stock price index in Jordan.

OBJECTIVES OF THE STUDY

1. To find the short run relationship between stock prices with Macroeconomic variables namely Exchange rate, Interest rate and Inflation.
2. To study the impact of these variables on stock prices of selected sectorial Indices.
3. To compare the impact of macroeconomic variables on stock index of different sectors considered for the study.

METHODOLOGY

This study is completely based on secondary data. The data have been drawn from various sources that have been acknowledged.

Research process: To find the impact of Macroeconomic variables on stock prices of two sectorial stock index which would help the investors and traders to forecast and diversify their investments.

Scope of the study:

Automobile and IT index listed in National Stock Exchange are taken for the study.

Time frame:

Time period considered for the study is from 2009 to 2014. The study uses monthly data.

Data collection:

This study is completely based on Secondary data. Data is collected from various published sources like journals, books, websites etc.

- Data on stock prices are collected from NIFTY.
- Data on interest rates are collected from RBI.
- Data on Exchange rates are collected from RBI.
- Data on Inflation are collected from Google.

Purpose: The purpose of this paper is to examine the linkage between the macroeconomic variables on the performance of the sector based stock market indices of NSE India.

Table 1: Description of Data

Name of the Variable	Symbol Used	Proxy Used
Stock Indices	CNXAUTO, CNXIT	Closing price of CNXAUTO and CNXIT
Exchange Rate	ER	Monthly average Rupee per unit of US$
Interest rate	IR	Weighted Average Call Money Rate
Inflation	IN	Consumer Price Index (CPI)

Table 1 points out the symbols and proxies used for Macroeconomic variables. The below model is used to analyze the effect of macroeconomic variables on performance of stock markets in India.

CNXAUTO = f (ER, IR, IN)

CNXIT = f (ER, IR, IN)

There can be both short and long run relation between the time series data considered for the study. To find out the short-run co-movements and multi-collinearity among the variables, Correlation coefficients are used. If correlation coefficients are greater than 0.8, it indicates the existence of multi-collinearity .

As a fundamental step of VECM (Vector Error Correction Model), ADF (Augmented Dickey Fuller) test is applied. This test is based on simple inference that non-stationery process has infinite memory as it would not show decay in a shock that may take place in the process. The ADF test is based on the hypothesis H0: Variable has a Unit root. If the calculate ADF value is less than the critical value or if the probability is less than 5%, null hypothesis is rejected and vice versa. If the variables are stationery at level, then they are tested at first difference. After testing for unit root, Johansen's co-integration method will be applied to test the existence of long run equilibrium relation between the variables. Johansen's test is based on two test statistics namely trace statistics and max-eigenvalue statistics. In the trace test statistics, the null hypothesis is that the number of distinct co-integrating vectors is less than or equal to the number of co-integrating relations. The Max-Eigen value statistics tests the null hypothesis of exactly r co-integrating relations against the alternative of r + 1 co-integrating relations with the test statistics "" . Finally the Granger Causality test is applied to test the direction of the relation between the variables.

Data Analysis and Observation

Table 2: Correlation Matrix

	CNXAUTO	CNXIT	ER	IR	IN
CNXAUTO	1.0000	0.8887	0.6593	0.8091	-0.2705
CNXIT		1.0000	0.5791	0.6723	-0.2524
ER			1.0000	0.6464	-0.2247
IR				1.0000	-0.5801
IN					1.0000

The results of the Correlation analysis between the stock market indices and macroeconomic variables are presented in Table 2. The results indicates that Exchange rate and Interest rates are positively correlated with the stock markets but Inflation is negatively correlated with the two sector based stock indices. There high correlations signals the existence of multi-collinearity among the variables.

Table 4: Unit root test

Variables	Test Critical Values			T-Statistics calculated	Prob-ability	H0: Variable has a Unit Root	Is it Stationary
	1%	5%	10%				
CNXAUTO	-3.546099	-2.91173	-2.593551	-1.945082	0.3099	Accept	No
Δ CNXAUTO	-3.546099	-2.91173	-2.593551	-6.232225	0.0000	Reject	Yes
CNXIT	-3.546099	-2.91173	-2.593551	-1.52215	0.5156	Accept	No
Δ CNXIT	-3.546099	-2.91173	-2.593551	-5.49624	0.0000	Reject	Yes
ER	-3.546099	-2.91173	-2.593551	0.030887	0.9573	Accept	No
Δ ER	-3.546099	-2.91173	-2.593551	-6.075249	0.0000	Reject	Yes
IR	-3.550396	-2.91354	-2.594521	-1.386786	0.5825	Accept	No
Δ IR	-3.550396	-2.91354	-2.594521	-6.820736	0.0000	Reject	Yes
IN	-3.546099	-2.91173	-2.593551	-1.659284	0.4464	Accept	No
Δ IN	-3.546099	-2.91173	-2.593551	-6.08095	0.0000	Reject	Yes

Results of the Augmented Dickey fuller test is presented in Table 4. The null hypothesis H0 is accepted for all the variables which reflects the existence of unit root among the variables. As the variables are non-stationery at level, all the variables are tested at first difference and the H0 variables are stationery is rejected. So it was found that all the variable considered for the study are stationery at first difference, i.e. I(1).

Table 5: Johansen's Co-integration test for CNXAUTO

H0	Trace Test	5% Critical value	Max. Eigenvalue test	5% Critical value
None	52.67641	47.85613	26.13305	27.58434
At most 1	26.54335	29.79707	16.6077	21.13162
At most 2	9.935653	15.49471	9.767922	14.2646
At most 3	0.16773	3.841466	0.16773	3.841466

Table 6: Johansen's Co-integration test for CNXIT

H0	Trace Test	5% Critical value	Max. Eigenvalue test	5% Critical value
None	55.66665	47.85613	31.62472	27.58434
At most 1	24.04193	29.79707	14.31392	21.13162
At most 2	9.728016	15.49471	9.717966	14.2646
At most 3	0.010051	3.841466	0.010051	3.841466

As all the variables are integrated of the same order i.e. at first difference I (1), Johansen's Co-integration model is applied to test the long run relationship between the variables. CNXAUTO and CNXIT are the dependent variables to which ER, IR and IN are the independent variables. Lag selection is made by the system. If the Trace statistics is less than critical value, we accept null hypothesis and if the Trace statistics is greater than critical value we reject H0. In the below case as the Trace statistics is less than critical value and also the Max Eigen value is less than the critical value there is one co-integrating equation at 5% significance level for both CNXAUTO and CNXIT.

Results of the Granger Causality test is represented in Table 7. Pair wise Granger Causality test has been performed between all possible pairs to test the direction of causality between each pair of variables. From the below table it is evidenced that Exchange rate granger cause CNXAUTO as well as CNXIT. We can see a unidirectional causal relationship running from Exchange rate to both the stock indices. We can also see a unidirectional causal relation between CNXIT and inflation running from CNXIT to Inflation and Interest rate and Inflation running from IR to IN.

Table 7: Grangers Causality

Null Hypothesis:	F-Statistic	Prob.	Decision
ER does not Granger Cause CNXAUTO	5.12857	0.0092	Reject
CNXAUTO does not Granger Cause ER	1.92613	0.1558	Accept
IR does not Granger Cause CNXAUTO	2.28868	0.1113	Accept
CNXAUTO does not Granger Cause IR	2.0587	0.1377	Accept
IN does not Granger Cause CNXAUTO	1.90032	0.1596	Accept
CNXAUTO does not Granger Cause IN	2.74576	0.0733	Accept
ER does not Granger Cause CNXIT	4.71646	0.013	Reject
CNXIT does not Granger Cause ER	0.70989	0.4963	Accept
IR does not Granger Cause CNXIT	0.13406	0.8748	Accept
CNXIT does not Granger Cause IR	0.51766	0.5989	Accept
IN does not Granger Cause CNXIT	0.16878	0.8452	Accept
CNXIT does not Granger Cause IN	3.43154	0.0397	Reject
IR does not Granger Cause ER	1.31661	0.2767	Accept
ER does not Granger Cause IR	0.22258	0.8012	Accept
IN does not Granger Cause ER	2.02586	0.142	Accept
ER does not Granger Cause IN	1.63144	0.2053	Accept
IN does not Granger Cause IR	0.06877	0.9336	Accept
IR does not Granger Cause IN	4.01048	0.0239	Reject

FINDINGS AND CONCLUSION

This research work tested the effect of Macroeconomic variables on the performance of the sector based stock indices by taking monthly data for the period 2009 to 2014. From the above analysis the following results can be interpreted: At First CNXAUTO, CNXIT, ER, IR and IN are integrated at the same order and are stationery at first difference. Second, there exists a long run relationship between the dependent variables and the independent variables considered for the study. Third, it is evidenced that there exists a unidirectional causal relationship between some variables running from Exchange rate to CNXAUTO, Exchange rate to CNXIT, CNXIT to Inflation and finally from Interest rate to Inflation. So a change in Exchange rate causes a change in the stock prices but not vice versa as in the first example.

From the findings of the study has some important policy implications. At first it is evident that exchange rate incorporates some significant data in forecasting stock prices and its performance. This helps the Reserve bank of the country in controlling and maintaining a healthy Exchange rate. Inflation and money supply plays a very important role in the functioning of the stock markets. By controlling the Repo rates and the Reverse Repo rates, the controlling body will help the country in controlling Inflation. The central bank of the country should also control the Interest rates in order to maintain the flow of money from one type of investment to another which would help in stabilization, effective working and development of the economy.

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