

Impact of Exchange Rate on Sectoral indices in India

Dharav Jamadar¹, Prof. Ajay Kumar Yadav²

¹Research Scholar, School of Business, AURO University, Surat (Gujrat) India.

²Registrar, AURO University, Surat (Gujrat) India.

ABSTRACT

This study tries to examine the relationship between the macro-economic variable and the share market. To establish this relationship we have undertaken exchange rate (US Dollar) and stock market indices – BSE AUTO, BSE IT, BSE FMCG, BSE Capital Goods and BSE BANKEX. The data has been taken from the time period of February, 2009 and February, 2019 on monthly basis. Johansen cointegration has been applied to check the long run relationship and cointegration between the macro-economic variable and share market. Fundamentally exchange rate might impact various sectors of the economy, though technically there might be other macro-economic factors that might impact much more significantly than the exchange rate. Granger Causality test has also been applied to check the impact of US Dollar long term as well as short term on the stock market indices. The results shows that US Dollar does not significantly impact the indices, hence there are many other variables that might be impacting the indices.

Keywords: macro-economic variable, stock market indices, exchange rate, Johansen cointegration test and Granger Causality test.

I INTRODUCTION

Over many years, number of researches have been conducted, both empirically and theoretically, the relationship between the macro-economic variables and the returns from share market. (Chen et. al., 1986 and Fama 1981, 1990) It is now a clearly explained finding that share prices react to the volatility in the various macro-economic variables. However very few research has been done on the impact of the macro-economic variables on different sectors of the economy in the emerging stock market.

Share market of any country plays a very critical role in the development of various industries and is also a barometer for the growth of the overall economy. Whilst there were many steps undertaken by researchers to stabilize the markets of the developing countries, but the share markets of these countries are characterized by the volatility that happens due to various uncontrollable economic factors (Rangel and Engel, 2005). The share markets of emerging economies are much likely sensitive than that of the under-developed or developed economies to the changes and volatilities that happens not only at the local micro level but also at the global macro-level.

This paper investigates the relationship between the exchange rate and the different sectors of Indian economy – BSE AUTO, BSE FMCG, BSE IT, BSE Capital Goods and BSE BANKEX from the period of 2009 – 2019. The main objective of the paper is to examine the impact of the exchange rates on the various sectors of the economy, which in turn will show that which of the following sectors does not get affected by the volatility in the exchange rate.

There are many compelling reasons why the research has been conducted – there are many researches that have been done in the past regarding the relationship between the macro-economic variables and the share market, but there is a paucity on impact on various different sector individually. In addition, particularly

the impact of exchange rate volatility on the various sector of Indian share market is missing. This research will actually fill the missing blocks in the bank of knowledge by addressing the impact of individual macro-economic variable on each sector individually.

The relationship between the macro-economic variables and the share market has always been an extensive contested topic. (Fama, 1970) According to Efficient Market Hypothesis, when the case is of efficient market, all the pertinent information about the volatility in the macro-economic variables are completely factored in the current market price of any share and henceforth the investors will only be able to earn normal profits. Now just going through the findings of Efficient Market Hypothesis than the volatility in any of the macro-economic variables will not affect the share prices at all. However, this conclusion was later thoroughly investigated by Schwert and Fama (1977) and many other researchers avowed that there lies relationship between the macro-economic variables and share prices and the volatility in share prices do influence the share prices. In Arbitrage Pricing Theory (APT) too, there lies theoretical relationship between the macroeconomic variables and the share prices.

Chen et. al (1986) is one of the ideal research that states there lies relationship between the volatility in macro-economic variables and the share prices movements on the basis of APT, and also establishes there exists long term relationship between them. On the international level, many of the researchers have been able to prove this relationship (Maysami et. al, (2004); Asaolu and Ogunmuyiwan, (2011)). But there is a dearth when it comes to strongly affirm the relationship between the volatility in macro-economic variables and share prices in India, though many researchers have tried to establish the relationship with the overall Index (see. Petheet. al, 2000; Bhattacharya et. al, 2006). Thus is a vital need for in depth study to understand which sector is the

most influenced by the volatility that happens in the exchange rate. Furthermore, Indian capital market is having a commendable run of growth and is now the leading capital market amongst the developing nation and has also started to be a benchmark for many developing nations.

II LITERATURE REVIEW

Fifield et. al. (2002), examined the local as well as the global economic factors that influences the share prices in emerging economies. GDP, interest rates, inflations rate represented the local macro-economic variables and world Industrial Production and world inflation acted as the global macro-economic variables. The global macro-economic variables had significant relationship the share market returns than that of the local macro-economic variables in the emerging share markets.

Returns from stock market highly correlated growth in money and fluctuation in interest rates Flannery et. al. (2002). 17 macro-economic variables were taken into account and then using GARCH model 6 of them were found to be price factored – Employment report, Balance of Trade, Housing starts, PPI, CPI and monetary aggregate.

Howe et. al. (2002), researched cointegration between various different macro-economic variables and different sector indices unlike traditionally researched composite indexes of Singapore. Various sectoral indexes like hotel index, property index, finance index, and different macroeconomic variables were undertaken to check the long-term equilibrium. The results showed that Singapore stock market and property index have cointegrating relationship with volatility in industrial production, interest rates, exchange rates and money supply.

Prices of stocks do reflect the profits that company might attain in future and these anticipated profits highly depends on the business cycles. Sadorsky (2002), tried to examine the macroeconomic factors prevailing in US, which might impact the technological stock prices. Three major factors were identified that affected the conditional volatility of the stock prices – the consumer price index, the term premium and the oil prices.

Bhanumurthy (2006), investigated the relationship between the various micro and macro-economic variables in examining their influence on the exchange rate volatility in the short run. In short run, many of the dealers feel that micro-economic variables influences strongly on exchange rates such as central bank intervention, market movement, information flow, speculation, etc.

Credit lending do not amplify the changes that happens in macro-economic variables Hofmann et. al (2006). The study tried to examine the nature of banks' lending to other NBFC during the times of changes in aggregate demand, supply and monetary

policies, especially in Germany and Euro region. Responses in both of the areas are much likely the same, though there were some differences in the movements of interest rates, inflation, output, etc.

Bloch et. al (2008), examined how the volatility in oil prices impacts various different indicators of macro economy like employment and investment, in Thailand. VAR was employed to study the impact of the volatility in the oil prices and Granger Causality Test further showed the response function of the oil prices significantly impacted the unemployment rate and investments.

Mahendruet. al. (2010), analyzed the long-term relationship between the various different macro-economic variables and the index of BSE SENSEX. The various different macro-economic variables includes foreign exchange rate, exchange rate, inflation rate and the prices of gold. Multiple regression model was employed to understand the relationship between the macro-economic variables and the stock market returns. The results showed gold prices and exchange rates highly influences the share prices whereas other variables like – inflation rate and foreign exchange reserves influences the share prices at a very limited extent only.

Investing in equities and capital market provides a unique option to the investors apart from traditional investment options, as investing in share market is directly related to the activities happening in the overall economy. Kalra (2012), using correlation and regression analysis found out that – gold prices, inflation and forex rates are the most critical factors that impacts the performance of SENSEX (stock market), in India.

Puja (2012), researched the relationship between the Indian share market and various different macro-economic variables – Industrial Production Index, treasury bills rate, wholesale price index, exchange rate and money supply. Vector error correction model and Johansen's cointegration are used to examine the long term relationship between the macro-economic variables and share prices. It was observed that Industrial Production Index and money supply had positive impact on the share prices, and the short run interest rate and exchange rate are the ones who were not having any significant relationship with the share prices. Long run relationship exist but not short relationship between macro-economic variables and share prices when it comes to Granger Causality.

Understanding the influence of interest rates on the Islamic banks is a critical aspect in understanding the framework of monetary and fiscal policies and even having a proper risk management of these institutions Arslan (2013). The research examined the impact of the volatility in interest on the working of Islamic banks. Using Vector Error Correction model they found that conventional theory that Islamic banks as work as interest free institution does not get impacted by the fluctuations in interest rates, stands incorrect when researched in Turkey – as the Islamic banks

were influenced by the fluctuations that happens in the interest rates.

Kabir (2014), real growth of economy highly influences the overall growth of share market. It was found that there lies strong statistical relationship between, Malaysian stock prices, foreign stock prices and exchange rates with the exchange rate as the most significant factor.

Chan (2017), researched the dynamic relationship between the various macro-economic variables – forex, GDP, interest rate and inflation rate and the performance of Small and Open Economy (SOE) in Malaysia. The research shows that, there lies long-term relationship among the macro economic variables, forex and GDP have positive relationship and GDP-interest rates and GDP-inflation rate had negative relationship.

Uncertainties in interest rates strongly influences the stock market. Hajilee (2017) researched the long run and short run relationship between interest rates and stock market of 12 emerging economies by using cointegration and vector correcting model. There was significant influence of interest on all 12 emerging economies in short run, but in 9 out of 12 cases interest rates in long run significantly impact emerging economies. Results also showed the monetary and fiscal policies making is a critical task especially in the emerging economies.

III METHODOLOGY

The following study employs the time series data obtained from two major sources i.e., Bombay Stock Exchange official website and from Reserve Bank of India official website. From the BSE official website the sectoral indices time series data was extracted and from the RBI official website, historical exchange rate time series data was taken. We have undertaken

exchange rate as the only macro-economic variable, as it is one of the most vital macro-economic variable. In addition, we have taken BSE AUTO, BSE FMCG, BSE IT, BSE Capital Goods and BSE BANKEX from the period of 2009 – 2019. These are some of the major sectors that depicts the growth of the overall economy, show also to see how the capital market of India is growing; these indices are taken in for research. The data undertaken has been from the time period of February, 2009 to February, 2019 on monthly basis. The data has been taken from BSE website and RBI official website.

The variables selected in the study has been based on the currently available theoretical propositions and the empirical evidences. As we know that in time series, must follow some of the properties, as it must be stationary, which means the mean and variance must always remain constant over the time and the covariance between the two time periods depends on the time frame between the required time period. The mostly and commonly used test to check the stationarity is the unit root test. Now three unit root tests are available Augmented Dickey Fuller test, Phillips-Peron test and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, and in this research, KPSS test has been selected to check the stationarity.

Then we need to check that whether there is autocorrelation, it is a common problem in the time series. Moreover, when the data series is having autocorrelation in it, the error term of the regression follows a pattern, which proves that there is something incorrect. Then Johansen cointegration test have been conducted to check that whether lies any cointegrating relationship between the data series. It helps us to establish the long run relationship or equilibrium in system with unit root variables (Rao, 2007).

Table No.1
Acronyms of the variables selected.

Acronym	Meaning
BSE AUTO	Index of auto and related companies listed on BSE.
BSE IT	Index of Information Technology and related companies listed on BSE
BSE FMCG	Index of Fast Moving Consumer Goods and related companies listed on BSE
BSE Capital Goods	Index of Capital Goods and related companies listed on BSE
BSE BANKEX	Index of Banking and other related companies listed on BSE
US DOLLAR	Amount of Indian Rupees to buy 1 US Dollar

Hypothesis

The below shown hypothesis are the ones that will be used in identifying the relationship between the independent variable and the dependent variables.

For BSE AUTO:

H0 = US DOLLAR does not have a significant relationship with BSE AUTO (p-value > 0.05)

H1 = US DOLLAR do have a significant relationship with BSE AUTO (p-value < 0.05)

For BSE IT:

H0 = US DOLLAR does not have a significant relationship with BSE IT (p-value > 0.05)

H1= US DOLLAR does have a significant relationship with BSE IT (p-value < 0.05)

For **BSE FMCG:**

H0 = US DOLLAR does not have a significant relationship with BSE FMCG (p-value > 0.05)

H1 = US DOLLAR does have a significant relationship with BSE FMCG (p-value < 0.05)

For **BSE Capital Goods:**

H0 = US DOLLAR does not have a significant relationship with BSE Capital Goods (p-value > 0.05)

H1 = US DOLLAR does have a significant relationship with BSE Capital Goods (p-value < 0.05)

For **BSE BANKEX:**

H0 = US DOLLAR does not have a significant relationship with BSE BANKEX (p-value > 0.05)

H1 = US DOLLAR does have a significant relationship with BSE BANKEX (p-value < 0.05)
Analysis

KPSS Test

Now let us check the KPSS test between the US Dollar and share market indices.

Table No. 2
KPSS Test analysis.

Indexes	Test statistic	10%	5%	1%	First difference
BSE AUTO	0.147	0.12	0.148	0.216	-
BSE IT	0.110442	0.12	0.148	0.216	-
BSE FMCG	0.138512	0.12	0.148	0.216	-
BSE Capital Goods	0.257135	0.12	0.148	0.216	0.0868293
BSE BANKEX	0.31216	0.12	0.148	0.216	0.0599227
US DOLLAR	0.228074	0.12	0.148	0.216	0.0754618

Now let us check the stationarity in the various data series that are undertaken in the research, that are 5 sectoral indices and 1 macro-economic variable, KPSS (Kwiatkowski-Phillips-Schmidt-Shin) test has applied to check the stationarity. Based on the above shown table we can see that t-stat of BSE AUTO, BSE IT and BSE FMCG are below the significance level of 1% i.e., asymptotic value of 0.216 and the t-stat for respective indices are BSE AUTO (0.147), BSE IT (0.11) and BSE FMCG (0.139) which clearly depicts that it is lower than 0.216. This means that all the three indices are stationary at the level itself. Now in case of BSE Capital Goods, BSE BANKEX and US DOLLAR we can see that the t-stat of theirs is bigger than the significance level of 1% with the

asymptotic value of 0.216; BSE Capital Goods (0.257), BSE BANKEX (0.312) and US DOLLAR (0.228). Now this shows that the data series is not stationary at level so now we need to add the first difference for the following three time series and now if we see the results, all of them are stationary at first difference i.e., BSE Capital Goods (0.087), BSE BANKEX (0.060) and US DOLLAR (0.075). Now we have to check the optimal lag order for each sectoral indices.

VAR LAG Selection

The below shown table depicts the VAR Lag selection model outcome for every sectoral indices selected for the research:

Table No. 3
Optimal lag order selection.

Lag Order	BSE AUTO	BSE IT	BSE FMCG	BSE Capital Goods	BSE BANKEX
1	16.501165*	15.383694*	14.412004*	16.602634	16.945699*
2	16.528936	15.398129	14.434499	16.622537	16.973476
3	16.523956	15.425899	14.417021	16.61053	16.958354
4	16.54743	15.45099	14.438514	16.577069*	16.982155
5	16.549205	15.475001	14.466552	16.586961	16.974294
6	16.576637	15.50227	14.477985	16.59959	17.000051
7	16.602207	15.524399	14.500155	16.620793	16.997765
8	16.629556	15.544684	14.504674	16.625002	17.02229
9	16.657724	15.573036	14.531793	16.651035	17.045355
10	16.685295	15.60104	14.523963	16.67053	17.068409
11	16.702324	15.617087	14.514803	16.696004	17.091562
12	16.730446	15.617092	14.542604	16.721268	17.11911

The above shown table depicts the no. of lags that are optimal for the study for each of the data series. The maximum no. of lags undertaken for the study are 12, and the figures with (*), shows that particular variable is optimal at that no. of lags. So now we can see the HQC (Hannan Quinn Criteria) for each of the sectoral indices, like for BSE AUTO, BSE IT, BSE FMCG and BSE BANKEX the optimal lag order is

one. Whereas for the BSE Capital Goods the optimal lag order is 4. This in turn is going to help us in examining Vector Autoregression.

(a) Autocorrelation

The below show table shows the test of autocorrelation of all the variables.

Table No. 4
Correlation of the data series.

Test for correlation		
No.of lags	Rao F	p-value
lag 1	2.175	0.0002
lag 2	1.718	0.0005
lag 3	1.717	0.0001
lag 4	1.589	0.0001
lag 5	1.592	0.0001
lag 6	1.553	0.0001
lag 7	1.599	0
lag 8	1.511	0.0001
lag 9	1.577	0
lag 10	1.568	0
lag 11	1.553	0.0001
lag 12	1.516	0.0003

Here we can see that the p-value in all the lag order is less than 0.05. So we can reject the null hypothesis, which in turn means that our series don't have autocorrelation in it. Now let us check the normality of the data series.

(b) Normality of the data series

The below shown table shows us the chi-square of the data series, which will help us to know that whether the data is normally distributed or not.

Table No. 5
Normality Distribution of the data series.

Residual correlation matrix, C (6 x 6)

1.0000	0.22602	0.66008	0.63679	0.68230	0.00075757
0.22602	1.0000	0.24495	0.17616	0.19723	0.083685
0.66008	0.24495	1.0000	0.40499	0.58667	0.090789
0.63679	0.17616	0.40499	1.0000	0.78438	-0.053441
0.68230	0.19723	0.58667	0.78438	1.0000	-0.030773
0.00075757	0.083685	0.090789	-0.053441	-0.030773	1.0000

Eigenvalues of C

0.177072
0.298424
0.601356
0.862087
1.08471
2.97635

Doornik-Hansen test
Chi-square(12) = 36.0899 [0.0003]

From the above table we can understand that the data series are normally distributed as the p-value in Chi-square is much below the required level of 0.05. So hence, we can reject the null hypothesis and say that the data is normally distributed.

Now we will check that whether there lies any relationship between the volatility in the exchange rate (US DOLLAR) and the various sectoral indices undertaken, using Johansen cointegration test.

(c) Johansen Cointegration test

The below shown table shows us the cointegration test between the (dependent variables) all 5 sectoral indices and the (independent variable) US DOLLAR.

Table No. 6
Johansen cointegration test analysis

Rank	Eigenvalue	Trace stats	Max-Eigen stats (Lmax test)	p-value
0	0.3471	101.77	46.47	0
1	0.22111	55.298	27.238	0.0075
2	0.18617	28.06	22.455	0.0796
3	0.048416	5.6047	5.4093	0.7428
4	0.0017903	0.19532	0.19532	0.6585

Here from the above table we can see that there is 2 cointegration equation, as the p-value is less than 0.05 so the null hypothesis is rejected. BSE AUTO and BSE IT are having p-value less than 0.05. And as max-eigen value is less than the trace stats so we shall examine the granger causality for all of the indices.

(d) Granger Causality Test

The below shown table shows us the granger causality between the independent variable (US DOLLAR) and the dependent variables (BSE AUTO, BSE IT, BSE FMCG, BSE Capital Goods and BSE BANKEX).

Null Hypothesis	lag order	p-value	Results
US DOLLAR do not granger cause BSE AUTO	1	0.12	ACCEPT
BSE AUTO do not granger cause US DOLLAR	1	0.28	ACCEPT
US DOLLAR do not granger cause BSE IT	1	0.17	ACCEPT
BSE IT do not granger cause US DOLLAR	1	0.20	ACCEPT
US DOLLAR do not granger cause BSE FMCG	1	0.06	ACCEPT
BSE FMCG do not granger cause US DOLLAR	1	0.07	ACCEPT
US DOLLAR do not granger cause BSE Capital goods	4	0.37	ACCEPT
BSE Capital Goods do not granger cause US DOLLAR	4	0.84	ACCEPT
US DOLLAR do not granger cause BSE BANKEX	1	0.14	ACCEPT
BSE BANKEX do not granger cause US DOLLAR	1	0.23	ACCEPT

Here it is proved that there is no “cause and effect” relationship between the macro-economic variable (US DOLLAR) and various sectoral indices. As the p-value of every equation is more than 0.05 so we fail to reject the null hypothesis. The null hypothesis over here is for eg. Independent variable (US DOLLAR) do not granger cause dependent variable (sectoral indices).

IV CONCLUSION

The research undertaken had the main objective of examining the relationship between the macro-economic variable i.e., US DOLLAR and various sectoral indices of India – BSE AUTO, BSE IT, BSE FMCG, BSE Capital Goods and BSE BANKEX. The macro-economic variable acted as an independent variable whereas all the sectoral indices acted as the dependent variable. Firstly, we checked the stationarity of the data series using the KPSS test, and found that BSE Capital Goods, BSE BANKEX and US DOLLAR were not stationary at level unlike

other time series but were stationary at first difference. Then optimal lag order for every data series was calculated where it was found that apart BSE Capital Goods which was having optimal lag order of 4, every indices were having the optimal lag order of 1. Then autocorrelation was checked among all the data series, where it was found that there was no autocorrelation exist in the data series. Then to check whether the data is normally distributed Chi-square was calculated where it is also proved that the data is normally distributed. Now Johansen cointegration test was applied to check that whether there is cointegration between the US DOLLAR and any of the sectoral indices, it can be seen that there is cointegration at 2 equation. So now to check the granger cause and effect relationship we have applied granger causality test. Here in turn we found that we failed to reject the null hypothesis as the p-value was above 0.05 in every case. So we can conclude that though exchange rate is a leading macro-economic variable but there are many other leading macro-economic variable that might be impacting the following sector significantly. So growth of these sectors is not significantly impacted by the volatility in the US DOLLAR.

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