AnExploratory Study onIndian Automobile Industry Response towards Macroeconomic Indicators during Post Liberalisation Financial Crisis

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***Abstract*— This study analyses the dynamic interrelation between automobile index of Indian stock market and macroeconomic variables. The traditional variable under observation in analysing stock market performance is always aggregate stock market index. However, the application of an aggregate index could lead to misleading interpretation on the actual performance of each sector in Indian Stock Market. It is believed that variations in macroeconomic variables could have different effects on sector-specific indices in terms of direction magnitude and persistence. Therefore, the main objective of this study is to analyse the long-run dynamic interaction between automobile index of Indian Stock Market and macroeconomic variation by proposing certain model for the sectoral index. Specifically, the proposed models refer to the periods of 2005-2015 when world was in grip of financial crisis.**

***Keywords*— Automobile Index, Macroeconomic Indicator, Long term, Short Term, Persistence, Magnitude, Direction**

I. INTRODUCTION

Liberalization and globalization are the two powers that have changed the Indian economy in the last two decades. The growth of the economy depends upon many elements, such as fundamental macroeconomic factors, investment climate, performance of industry sectors and global business environment. An understanding of the macroeconomic factors that influence the movement of stock prices and the role of sector indices, that represent a variety of industries in economic growth, is essential for investors as well as policy makers.This study attempts to find out response of automobile industry towards selected macroeconomicvariables.CNX Auto Index is selected as representative variable for automobile industry.TheNifty Auto Index represents about 8.47% of the free float market capitalization of the stocks listed on NSE and 90.69% of the free float market capitalization of the stocks forming part of the Automobiles sector universe as on March 31, 2015 (www.nseindia.com).

Thus, a comprehensive analysis on the dynamic relations between macroeconomic variables and automobile index should be addressed in order to have a better understanding of macroeconomic changes in relation to fluctuation in automobile specific index.

II. LITERATURE REVIEW

Wang G & Lim C (2010) examined the impact of macroeconomic variables on theindustry stock returns in Australia. The 10 macroeconomic variables include changes in ASX P/E ratio, exchange rates between the Australian, New Zealand and US $, ASX bond index return, dividend yield of ASX200, ASX market return and capitalization, the official cash rate, interbank interest rate, treasury bill yield and unemployment rate. The time series regression analysis shows that macroeconomic factors are important determinants of the ASX industry returns. Further there is a positive significant relationship between the industry returns, exchange rates and market returns. **Ewing, Forbes & Payne (2003)** studied how shocks to macroeconomic variablesaffects five major S&P sector specific stock market indices, namely, utilities, transportation, industrial, financials and capital goods. The research uses generalized impulse response analysis and identifies various responses of the sectors to unanticipated changes in some key macroeconomic variables and it also found strong interrelationships amongst five S&P's stock indices. **Lee, Boon &Baharumsha (2001)** explored the dynamic linkages betweenmacroeconomic fundamentals, economic growth and the Kuala Lumpur Stock exchange index before the 1997 Asian crisis for quarterly data from 1987:1 to 1997:2 by employing VAR model. Two models were set up. The first considered

7macroeconomic variable including stock price index, inflation rate (CPI), interest rate, industrial output, money supply (M3), exchange rate and trade balance. This model was estimated with various stock indices, including the composite index, industrial index, Finance index, property index, plantation index and mining index. The second model which included the stock capitalization, stock volume, real GDP and saving helped to investigate the contribution of Malaysian stock market to economic growth. The two significant findings are that macroeconomic variables are significantly important for determining movements in stock prices in both the short- and long-run. A healthy stock market is important for economic growth.

III. OBJECTIVE OF THE STUDY

- To investigate longrun and short runrelation between selected macroeconomic variable and Automobile Index.
- To examine the causality among selected macroeconomic variable and Automobile Index.

IV. RESEARCH DESIGN

Extensive exploratory research has been conducted by reviewing the literature so as to identify relevant macroeconomic variables and suitable methodologies used for conducting the study.

V. SAMPLE PERIOD

Liberalisation and globalization have brought major changes in Indian economy after 1991.The world economy and Indian economy were rising post 1991. In 2004 there were many regulatory changes in banking sector as well as equity market. Apart from India registered very high growth during 2003-08 prognosticating as emerge of economic super power. This was followed by recession in world economy, which has not affected India much. Considering all this fact sample period is taken as March 2005 to April 2015.

VI. VARIABLES OF THE STUDY

Independent Variable: Economic Growth, Oil price, Money Supply, Inflation,Foreign Investment, Exchange Rate, Short term interest rate, Long term interest rate ,Over all stock market performance, Overall global stock market performance
Proxy Variables: IIP (G), Oil Import, M3,WPI ,FDI, Rupee/Dollar, T Bill ,G-Sec, Nifty, Nasdaq Composite
Dependent Variable: Automobile Sector specific index listed in National Stock Index has been taken as dependent variable.

VII. CONCEPTUAL FRAMEWORK

The hypothesized relation between the identified macroeconomic variables on the basis of the literature review and theoretical framework for the study

Automobile Sector Specific Index=f (IIP, Exrate, Nifty, Nasdaq, Oil Price, WPI,short term interest, long term interest, Money supply,FDI).

It is assumed that there exist long-run, short-run and causality relationships between macroeconomic variables.

VIII. DATA ANALYSIS

Time Series of Log Transformation

Log transformation of time series of macroeconomic variables reduces peakedness and variability of distributions. It scales down the sample statistics values, including mean, mode and median, and reduced skewness and kurtosis of the distributions. All variables are transformed into natural logarithm and their first difference is taken. **Table 1**gives transformation of variables and their significance.

Transformed Variable	Growth Rate	Significance
Log AUTO=lAuto	gAuto=D(lAuto,1)=log($Auto_t$/$Auto_{t-1}$)	Return in automobile Index
LogWPI=lWpi	gWpi=D(lWpi,1)=log(Wpi_t/Wpi_{t-1})	Growth in Inflation
LogIIPG=lIipg	gIipg=D(lIipg,1)=log($Iipg_t$/$Iipg_{t-1}$)	Growth in Industrial Performance
LogOILIMPORT=lOilimpt	gOimp=D(lOilimp,1)=log($Oilimp_t$/$Oilimp_{t-1}$)	Growth in Oil Price
LogM3=lM3	gM3=D(lM3,1)=log($M3_t$/$M3_{t-1}$)	Growth in Money Supply
LogFDI=lFdi	gFdi=D(lFdi,1)=log(FDI_t/FDI_{t-1})	Growth in Foreign Investment
LogT-Bill=lTbill	gTbill=D(lTbill,1)=log($TBill_t$/$TBill_{t-1}$)	Growth in short term interest.
LogG-Sec=lGsec	gGsec=D(lGsec,1)=log($Gsec_t$/$Gsec_{t-1}$)	Growth in long term interest rate
LogExrate=lExrate	gExrate=D(lExrate,1)=log($Exrate_t$/$Exrate_{t-1}$)	Growth in exchange rate
LogNIFTY=lNifty	gNifty=D(lNifty,1)=log($Nifty_t$/$Nifty_{t-1}$)	Return of domestic stock market performance
LogNasdaq=lNasdaq	gNasdaq=D(lNasdaq,1)=log($Nasdaq_t$/$Nasdaq_{t-1}$)	Return of international stock market performance

Table 1: Time Series Log Transformation

Descriptive Statics (Log transformed variable)

Standard deviation is highest for FDI and lowest for Ex rate (Table 2).All distributions are negatively skewed except oil import, money supply, FDI and T-bill. Kurtosis for FDI, T-Bill and **G**-Sec is more than 3 which indicates peakedness in these variables. It indicates huge variation in data.

Data between April 2005 and March 2015 (log transformed)

	Mean	Std. Deviation	Skewness	Kurtosis
WPI	0.00	0.01	-0.27	1.13
OIMP	0.02	0.13	0.08	-0.53
IIP-G	0.01	0.06	-0.13	0.42
M3	0.01	0.01	1.43	3.89
NASDAQ	0.01	0.05	-0.59	5.70
FDI	0.24	1.08	4.89	33.74
ExRate	0.00	0.02	0.68	1.08
T-bill	0.01	0.14	2.99	24.94
Nifty	0.01	0.06	-0.45	2.45
GSec	0.00	0.04	-1.59	11.11
Auto	0.02	0.07	-0.85	1.82

Table 2: Descriptive Analysis

Correlation Matrix of Log Transformed Variables

All the selected macro-economic variables have strong impact on automobile sector.

Second striking feature of both the tables is significant and strong correlation of World stock market (NASDAQ) on Automobile Index.

Third finding of this table is overall domestic market index (Nifty) has shown strong correlation with automobile sector index..
Exchange rate and automobile sector specific indices are showing positive relation between each other.
Although interest rate generally has negative relation with stock prices, we get a reverse result where interest rate (T-bill and G sec) show positive correlation with automobile sector index. During the taken sample period inflation in India shows increasing trend. It can be argued that to get inflation protection investment would have shifted to various sectors of the stock market.

	WPI	**Olmp**	**IIPG**	**M3**	**Nasdaq**	**FDI**	**Ex-rate**	**T-bill**	**Nifty**	**G-Sec**	**Auto**
WPI	1	.947**	.879**	.987**	.862**	.594**	.833**	.508**	.832**	.564**	.892**
lOImp		1	.857**	.921**	.800**	.615**	.713**	.554**	.808**	.681**	.814**
lIIPG			1	.919**	.694**	.687**	.582**	.365**	.856**	.488**	.786**
lM3				1	.817**	.639**	.802**	.415**	.853**	.498**	.877**
lNasdaq					1	.433**	.751**	.637**	.846**	.659**	.929**
FDI						1	.353**	.251**	.670**	.345**	.485**
Ex-rate							1	.388**	.556**	.318**	.732**
T bill								1	.425**	.678**	.471**
Nifty									1	.598**	.900**
G-Sec										1	.609**
Auto											1

Table 3: Correlation between Log Transformed Variables

Test of Stationary

Table 4 shows result of ADF test for all variables, All variables are found to be non –stationary for significance level of 5% in the models Constant with trend for the selected sample period.

(Level& First Difference)

	At Level		**First Difference**	
	T-Static	**P-Value**	**T Static**	**P-Value**
Auto	-2.35086	0.4033	-6.981034	0.000
Ex Rate	-2.254664	0.2122	-7.729441	0.000
Fdi	-6.843977	0.000	-17.84320	0.000
G-Sec	-3.373846	0.4452	-7.741455	0.000
IIP-G	-2.334614	0.2653	-3.459128	0.0492
M3	-0.128556	0.6621	-3.079757	0.1165
Oil Import	-2.876370	0.0621	-5.929470	0.000
T Bill	-1.984932	0.7715	-14.31594	0.000
WPI	-1.520805	0.2825	-6.747411	0.000
Nasdaq	-1.382038	0.4876	-8.998462	0.000
Nifty	-3.211064	0.0754	-8.367933	0.000

Table 4: ADF Stationarity Test Result

It has been seen that all variables are stationary at first difference except M3 for the model constant and trend..FDI is stationary at level. In order to test for Cointegration which indicates long-term relationship of the times series; it is necessary that they should be stationary at the same level. The following is a similar sequence of tests to check stationarity of the 1st difference of log transformed time series before applying Cointegration test.

Above Table shows all variables are stationary for its first difference. FDI has not been included in this analysis as these variables were stationary at levels. The model considered for the analysis is constant and trend.

lM3 is non-stationary for the selected model constant and trend .It is found to be stationary at second difference. So M3 is also not been include for Cointegration analysis.

Long run and Short run relation between CNX Auto Index and macroeconomic variables

Proposed model for long run & short run relation is adaptation of multivariate Cointegration model.

$$R_i = b_{i1}\ IIP\text{-}G + b_{i2} Exrate + b_{i3} Tbill + b_{i4}\ G\ Sec + b_{i5}\ WPI + b_{i6}\ Nifty + b_{i7}\ Nasdaq + b_{i8}\ Oil\ Import + e_i$$

Where

R_i=Return of Automobile Index

$b_{i1}, b_{i2} ..... b_{ik}$=sensitivity of the factor

e_i=error term

First Step in Johansen Cointegration test is to determine lag length. It is seen log transformed automobile index and macro-economic variable are I(1) or the growth series of automobile sector index and macroeconomic variable are I(0), which is required condition for Co-integration analysis. Further, Trace static and Max- Eigen value have been refereed to identify whether co-integrating vector exist or not. Followed by Error Correction Model is applied to check short run dynamic in long run. The whole analysis is done on assumption that all series have linear deterministic trend.

The hypothesis which has been tested is:

H0: There is no long run and short run relation between automobile index and macro-economic variable.

Lag length for Automobile Index

Table 5 provides Log Likelihood, Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC) values. According to result AIC gives lag length 2 whereas SC and HQ give lag length 1.

Lag	AIC	SC	HQ
1	-15.48651	-15.27287	-15.39978
2	-34.25014	-32.11373*	-33.38288*
3	-34.94377*	-30.8846	-33.29598
4	-34.49884	-28.5169	-32.07051
5	-34.29394	-26.38923	-31.08508

**indicate lag order by criterion at 5% AIC:Akaike information criterion*
SC: Schwarz information criterion HQ: Hannan-Quinn information criterion

Table 5: Lag Length for Automobile Stocks

Johansen Cointegration Test

The result shows presence of co-integrating vector between CNX automobile index and selected macro-economic variables. The trace-test and rank test confirms presence of co-integrating equation between CNX automobile index and macro-economic variable at 5% significance level with linear & deterministic trend. (Table 8&9).This indicates long run relation between automobile index and identified macroeconomic variable.

Lag Interval (in first difference):1

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 CV	Prob.**
None *	0.404	60.99434	58.434	0.0274
At most 1	0.284	39.45096	52.362	0.5295
At most 2	0.259	35.41720	46.231	0.4336
At most 3	0.208	27.57929	40.078	0.5919
At most 4	0.186	24.35049	33.877	0.4302
At most 5	0.119	14.96264	27.584	0.7512
At most 6	0.096	11.92118	21.131	0.5555
At most 7	0.075	9.285645	14.265	0.2631
At most 8	0.028	3.365225	3.841	0.0666

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level

Table 6: Max Eigen Value Test for Automobile Sectors Stock

Lag Interval (in first difference):1

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 CV	Prob.**
None *	0.404	227.327	197.37	0.0006
At most 1 *	0.284	166.333	159.52	0.0201
At most 2 *	0.259	126.882	125.62	0.0418
At most 3	0.208	91.464	95.75	0.0952
At most 4	0.186	63.885	69.82	0.1358
At most 5	0.119	39.534	47.86	0.2396
At most 6	0.096	24.572	29.80	0.1773
At most 7	0.075	12.650	15.49	0.1283
At most 8	0.028	3.365	3.84	0.0666

Trace test indicates 3 co integrating eqn(s) at the 0.05 level

Table 7: Trace Test for Automobile Sectors Stock

However number of Co-integrating equation differs in trace test and rank test. Where trace test identifies 3 Co-integrating equations at series being linear deterministic, rank test confirms only one equation. The positive side of this result is minimum one co-integrating equation is present between automobile index and macro-economic variables.

So, the null hypothesis is rejected and long run equilibrium relation exists between automobile index and macroeconomic variable.

The automobile sector stock index variability is related to macro-economic variable and is explained by normalized co-efficient of Johansen Test (**Table 8**)

t- statistics in [ ]

CointegratingEq:	CointEq1
N_AUTO(-1)	1.000000
WPI(-1)	-0.191378
	[-0.15582]
OILIMPORT(-1)	0.901244
	[3.45886]

CointegratingEq:	CointEq1
EXRATE(-1)	-2.256737
	[-3.82601]
NIFTY(-1)	0.107195
	[0.35024]
NASDAQ(-1)	-0.091916
	[-0.25484]
TBILL(-1)	-0.621679
	[-3.69625]
GSEC(-1)	0.818421
	[1.19002]
IIPG(-1)	-2.568062
	[-3.46969]
C	13.01299

Significance Level 5%

Table 8: Long run Co-integrating Equation(Automobile)

According to **Juselius,** in multivariate Cointegration analysis all variables are stochastic and a shock to one variable is transmitted to all other variables through the dynamics of the system until the system found its new equilibrium position.

Johansen and Juselius (1990) considered the **first cointegrating vector to be more useful than the others.**

The long run regression equation is presented by:

N_Auto=0.191 * WPI - 0.901 * Oilimport+2.26*Exrate- 0 .107 * Nifty + 0.092 * Nasdaq + 0.622 * T-bil l - 0.818 * G-sec + 2.568 * IIPG

Automobile sector has long term relation with oil price short term interest, industrial performance & exchange rate. The relation is positive with all significant factors except oil price. Oil price has negative impact on automobile sector.

	Significant Economic Variable	t-value
Automobile	Oil Price(-)	3.46
	Exchange Rate(+)	3.82
	Short term Interest(+)	3.70
	Industrial Performance(+)	3.47

Table 9: Summary of Significant Long Run Co integration Relation between Economic Variable & Automobile Index

Error Correction Term

These regression coefficient terms in the ECM will give short-run relation as well as adjustment factor between automobile index and economic variable. The hypothesis to be tested is

H0: There is no short run relation between automobile index and macroeconomic variable.
H1: There is short run relation between automobile index and macroeconomic variable.

The adjustment factor of D(N_auto) α11= --0.028038, the adjustment factor associated Cointegrating Equation (CE) brings back the system to equilibrium. Every month 2% disequilibrium is corrected for auto index .As t-value=-2.70483>1.96 the adjustment coefficient is significant. Table 11. This rejects null hypothesis and shows short term relation between economic variables and automobile index.

In case of Auto-index only Industrial performance or GDP, short term interest and exchange rate are significant variable for short run relation .Another point which is indicated in the table is auto index shows positive relation with its lagged value.(Table 10).This shows existence of spill over effect in auto index.

t-statistics in [ ]

Error Correction:	**D(N_AUTO)**
CointEq1	-0.028038
	[-2.70483]
D(N_AUTO(-1))	0.462261
	[3.34203]
D(WPI(-1))	-0.012539
	[-0.02900]
D(OILIMPORT(-1))	0.028652
	[1.18483]
D(EXRATE(-1))	-0.283159
	[-2.05991]
D(NIFTY(-1))	-0.053031
	[-0.71842]
D(NASDAQ(-1))	0.008805
	[0.13059]
D(TBILL(-1))	0.042481
	[2.06685]
D(GSEC(-1))	-0.009065
	[-0.14300]
D(IIPG(-1))	-0.106880
	[-2.22452]
C	0.005585
	[1.72818]
R-squared	0.286050
Adj. R-squared	0.219326
F –Static	4.287044

Significance Level 5%

Table 10: Error Correction Terms (Automobile Index)

Thus in short run these three variable causes Auto index , remaining are insignificant. Further, as Adj R^2 = 0.219, therefore, only 22% variation in growth in Auto index return can be explained by lag growth of independent variables. Further, as value of F=4.29 >1.96, this implies rejection of the joint null hypothesis H0 : Π 1i =0 for all i. Therefore, the regressors are significant and the model is a good fit though it does not explain 78% variation in growth of Auto index.

Granger Causality Test

Granger Causality for a co integrated set of variables suggests that the causal relationship between these variables should be examined within the framework of VECM.

H0: There are no causality relationships between Auto index and macroeconomic variables.

Table 11 summarizes the result of Granger Causality Test.

Economic variable and Auto Index

	p-Value
g(EXRATE) causes g(AUTO)	0.0394
g(IIPG) causes g(AUTO)	0.0261
g(TBILL) causes g(AUTO)	0.0387

Significance Level 5%

Table 11: Granger Causality Test

The variables are exchange rate, Industrial performance and short term interest, where auto index shows bidirectional relation with short term interest. Besides, in the given framework of VECM for Auto Index

Thus, Automobile sector shows long term as well as short term relation with macro-economic variable. This implies automobile stock market is informational inefficient and significant macroeconomic variable can be used to predict stock price of automobile sector.

IX. CONCLUSION

Automobile sector stocks are informational inefficient, so investors are required to do a proper research on various economic indicator before making investment.

The Cointegration analysis has shown that there are short-run and long-run relationships between automobile index and these variables. However, owing to limited and delayed availability of information, there are inefficiencies in the transmission of information between the fundamental economic activities and the market; this is fertile ground for arbitrage/insider trading. Adoption of modern information technology, shorter compliance periods and more severe penalties for non-compliance can significantly improve this situation.

The ECM used is in analysis demonstrate casual relation between exchange rate, industrial performance, inflation and automobile index. Thus, from the past value of variables in these cases, one could have made a short-run forecast of the present value of other variables, which can be used for the formulation of short-term policies and strategies.

X. REFERENCES

Journal Article with no DOI

[1]. Wang G & Lim C (2010), "Effect of macroeconomic factors on share prices", *Journal of International Finance and Economics*, Vol 10, number 2, 2010.

[2]. Ewing B.T, Forbes SM and Payne JE (2003), "The effect of macroeconomic shocks on sector specific returns", *Applied Economics*, 35, 201-07

[3]. Lee, &Baharumsha (2001), The stock market ,macroeconomic fundamentals and economic growth in Malaysia, Asia Pacific, *Journal of Economics & Business*, Vol.5, no2.

Website

[1]. **www.nseindia.com**

[2]. **www.dbie.rbi.org**