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- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio," Ohio State University.

Contributions to books

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

Journal and other articles

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

Conference papers

- Chandel K.S. (2009): "Ethics in Commerce Education." Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

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- Kumar S. (2006): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

Online resources

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- Kelkar V. (2009): Towards a New Natural Gas Policy, Economic and Political Weekly, Viewed on February 17, 2011 http://epw.in/epw/user/viewabstract.jsp

A STUDY OF RETURN, LIQUIDITY OF SECTORAL INDICES, MARKET INDEX RETURN OF INDIAN FINANCIAL MARKET (BSE)

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ABSTRACT

Market return represents the total return of the market index. It is found that performance of the few sectoral indexes is very high compared to the market index return. This study finds the variance in all sectoral indices and the market Index (BSE) return and illustrates the significance of the individual sector performance and their impact upon on the market index returns. The paper has also explained the liquidity of the sectoral indices and market index on the basis of price returns by calculating market efficiency coefficient. The paper find that the sensex returns can be explained with the help of selected sectoral index returns. The study is carried out in different phases and has found significant difference with inclusion of power and realty sector. It is the time lag which increases the model fit and inclusion of realty and power indices returns also increase of fitness in ARIMA model. This paper exemplify that forecasting of the sensex returns with help of differenced first order regressive method provides better results. The peculiar observations reveal that health and consumer durable indexes are earning against the market index returns, whereas Technology, oil, Capital goods and banking remained the main contributors to the overall market index returns. GARCH models illustrate that lower volatility clustering involved with the presence of the realty and power sectoral indices. The liquidity measured on the basis of Market efficiency coefficients (MEC) have provided that the sectors like health care, consumer durables and the auto sectoral indices have high long term variance in the returns where as oil and gas sector have lower value. It is found that all sectoral indices of BSE have more than one as MEC, indicating the higher long term variance than short term variance of sectoral indices.

KEYWORDS

Liquidity, Financial, BSE, Return, Index.

INTRODUCTION

This paper is an attempt towards the understanding of the variance of returns of sectoral index returns in relation with the BSE (Bombay Stock Exchange) sensex returns (BSE is a leading stock exchange and hence took as proxy for Indian financial market). At the same time Explain ability of the sensex returns with help of aggregated sectoral indices returns.

The various indexes considered are auto, banking, technology, oil, health, consumer durables, capital goods, FMCG, Metal in the phase one and the second phase realty and power sector indices are also added. Major of the studies have been done on the sectoral returns with respect to the diversification and optimum portfolio management. Hence there has a necessity for the understanding the characteristics of the sectoral returns as individual and combined with respect to the market returns. The data of sectoral returns were taken from the Bombay stock exchange (a leading stock exchange present in India) defined indices as these indices are regularly adjusted by the BSE whenever there was requirement for the appropriation on the basis of market capitalization. This provided the data that is better refined than an individual selecting few organisations representing the industry.

LITERATURE SURVEY

The sectoral study related with the diversification and the optimum portfolio management have been the interested area for the researchers from many decades. However the studies of sectoral returns as individual have been scarce.

Studies are focussed on the diversification of portfolio either by divesting in the different sectoral indice in the same market or by divesting in different markets in the same sectoral indice. Meric, Ratner, & Meric (2008) found that the global diversification in the bull market of same sector is better than diversification in an individual market with different sectors. Especially in the bear market all sectors in the local market are correlated and hence global diversification would provide a better returns. Demirer & Lien (2005) works on the understanding of the correlation between the different sectoral related with market movement in either direction. The studies finds that the sectoral correlation is higher in the upside movement market. Only for finance sector had the strong correlation in the down side market in the context of china markets. Where as in USA the sectoral indices had the correlation with the market in the down side movement and these correlations became very strong in the time of the extreme movements. Wang, Kutan, & Yang (2005) authors have worked with the information of the Chinese stock markets. The authors found that there is higher dependence of stock exchanges on each other for the information. At the same time it has also been found that there was constant reflection on the prices of one sector depending on the information of the other sector. Industry sector is found to be most integrated with the impact on each other due to the information flow and the finance sector could stay alone or indifferent to the other sectors information.

Shengying Li authors have worked on the sectoral exposure on the portfolio to any specific risk factor, and building the optimum portfolio optimization or understanding the risk management. You & Daigler (2010) argues that the correlation on the basis of simple constant correlation ship in designing of the diversification portfolios is at error. Instead the consideration of the dynamic changing nature of the correlation between the different indexes in the markets of world would provide a better analysis. Using of the conditional correlation, eventual tail risks, skewness and the standard deviation analysis says that there is a diversification benefit. However the tradeoff exists in between the variance and standard deviation analysis. Joseph (2003) works on the data of the stock markets of US, Forex and interest rate changes impact on the stock market index returns. It has been found that there is no impact of the Forex and interest rate changes on the stock market returns generation. However the variance in the sectoral indices were influencing in the future performance of themselves.

Malik & Ewing (2009) study focuses on the weekly returns for fifteen years data on different sector movements and the transmission of volatility. Study successfully found the relation between the different sectors. At the same time it is found that in the oil shocks the volatility was transmitted to other sectors. That is volatility of one sector had influenced the volatility on dependent sectors and hence the studies with respect to the sectoral interdependencies needs to undertaken so decrease the risk and build the diversified portfolio. Kallberg & Pasquariello (2008) authors have done analysis on the 81 sectoral indices of the US market and had found there has been large correlation between the excess movements in the sectoral indices. That is there is significant impact between each other in the movement. However there is weak asymmetric that is all indices were significant in movement in a single direction. US monetary and real situations had a positive correlation where as short term interest rates had generated a negative correlation for the sectoral excess square correlations. Patra & Poshakwale (2008) have worked on the sectoral indices data of the Athens stock exchange. It has been found there has been lower relation in the sectoral returns in the long term. However there was significant impact of the banking sector on the other sector indices returns and variance. This paper suggests the changes and information of the banking sector could be used in order to predict the returns of the other sectoral indices in short term. Lafuente & Ruiz (2004)

have worked on the data of the Spanish new market index. The paper focuses on the returns versus volatility of the sectoral indices. It has been found that there is significant impact of the volatility of the new market index on the other sectors like financial, industrial etc. However only industrial sector expects the higher risk premium especially when global shocks in technological sectors.

Mazouz & Saadouni (2007) authors work on the FTSE 100 index. Authors have employed GARCH and residual variance of the single index model in order to understand the liquidity characteristics in the time of index revision. It has been found that the added or deleted stocks have reflected the permanent change in terms of price and volume. McMillan & Kambouroudis (2009) have worked with the GARCH and APARCH models in determining the forecasted values for the risk parameters in the G7 and the Asian countries. They could find that these models provided superior prediction compared to VAR forecasting methods. Groenewold, Kan Tang & Wu (2008) authors have worked with the regression models for the forecasting and could provide returns in between 2 and 11 in the shangai market. They had used the recursive estimation procedure for the forecasting equation.

The studies by Chakrabarti, Huang, Jayaraman, & Lee (2005) have worked on the liquidity effect on the stock due to getting added into the sectoral indices. It has been found that on the basis of returns and volume analysis that there was increase in the liquidity and return generation. The work was done on the MSCI indices. However there was decrement in the liquidity in the stocks when they were deleted from the sectoral index. Hegde & McDermott (2003) works on the S&P 500 index firms. It has been found that the results were in concurrence in the previous studies. That there was an increment in the liquidity of the stocks, which were either included or deleted in from the stock index. This is due to the change in the information flow of the organisation depending on the membership in the index. At the same time decrement in the transaction costs would also increase in the liquidity once forms the stock of the sectoral index. Johnson (2008) author has specified that there was no relation between the liquidity and the volumes of the financial assets. However there is a strong relation of the volume on the variance of the liquidity of financial stocks.

Lybek & Sarr (2003) authors have worked on the measurement of the liquidity of the market indexes across the globe. The liquidity measure were categorised into four categories that are on the basis of transaction costs, volume based, price based and market impact measurements. The paper has focussed on significance on the liquidity of the markets over the liquidity of the individual financial assets. The Market efficiency coefficient is used in the understanding of the liquidity of the market on the basis of price returns. Park, Rhee, & Shin (2006) authors uses the Market efficiency coefficient in understanding the characteristics of the liquidity characteristics of the short term and long term bonds. It has provided the better understanding of the liquidity characteristics especially in terms of short term and long term variance.

RESEARCH OBJECTIVES

To understand the variance of the sectoral indice and market index in terms of returns. Then in the further process is to analyze the impact of mutual influence between the any two sectoral index returns and on market index return. Finally to understand the liquidity impact of sectoral indices return on the market index return.

METHODOLOGY

The weekly returns data has been collected for the twelve sectoral indexes of BSE available along with BSE sensex.

The step wise multiple regression analysis is undertaken in two phases.

First phase consists of the data for ten sectoral indexes and sensex returns for a period of past five years. The period starts from 3rd December 2004 to 25th February 2010. Both realty and power sector indexes were not undertaken.

The regression equation considered in phase 1 is

Sensex returns = a* Auto Index returns +b* Oil Index returns + c* Metal Index returns + d*Capital Goods Index returns + e* Consumer durables Index returns + f* Information Index returns + g* Health Index returns + h* Technology Index returns + I* Banking Index returns +J* FMCG Index returns +constant

Second phase consists of the data from 16th November 2007 to 25th February 2010. Here all the sectoral indexes were included. Indexes of power and realty were formed in November 2007 (appendix).

The regression equation considered in phase 2 is

Sensex returns = a* Auto Index returns +b* Oil Index returns + c* Metal Index returns + d*Capital Goods Index returns + e* Consumer durables Index returns + f* Information Index returns + g* Health Index returns + h* Technology Index returns + I* Banking Index returns +J* FMCG Index returns + k* Power Index returns + l* Realty Index returns +constant

Multi-Collinearity test was also undertaken.

Forecasting through ARIMA was undertaken at a lag of one period to understand the influence of sectoral indexes past returns on the present sensex returns. Both the random walk method and single first order differentiated auto regressive equation to forecast the sensex returns. GARCH modelling has been undertaken to understand the volatility of the indices and its impact on the market return.

Market efficiency coefficient (MEC) is calculated to understand the liquidity characteristics of the each sectoral indice and market index. At the same time the impact of the liquidity of sectoral indice on the liquidity of the market index. Especially with the inclusion of the real and power sectoral index.

MEC = variance of the long term returns / (n * variance of the short term returns)

n= number of short terms in one long term

The short term considered in this study is a week and long term consists of four weeks.

DISCUSSION

The first regression was conducted on the ten sectoral index data and the following resultant table were obtained from the PASW.

TABLE I: REGRESSION ANALYSIS STOCK MARKET RETURN (BSE) AS DEPENDENT VARIABLE AND 10 SECTORAL INDICES RETURN AS INDEPENDENT VARIABLES

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
8	.993[h]	.986	.985	.0048194	2.191

TABLE II: COEFFICIENT OF REGRESSION ANALYSIS STOCK MARKET RETURN (BSE) AS DEPENDENT VARIABLE AND 10 SECTORAL INDICES RETURNS AS INDEPENDENT VARIABLES

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
8 (Constant)	.000	.000		-1.573	.117		
OilGas	.234	.012	.274	20.083	.000	.293	3.417
Bankex	.190	.009	.267	19.981	.000	.306	3.270
Teck	.271	.013	.260	21.010	.000	.356	2.812
CapitalGoods	.143	.012	.187	12.454	.000	.242	4.135
FMCG	.093	.012	.078	8.084	.000	.582	1.719
Metal	.047	.009	.075	5.043	.000	.245	4.078
Consumer	-.036	.009	-.049	-4.119	.000	.381	2.627
Auto	.045	.013	.048	3.455	.001	.285	3.504

Table I provides the information of the regression model and the explain ability. The high R square value indicates the fitness of the model and coefficients of independent variable in the regression equation can be considered for the further analysis. R-Square is 98.6% and the fit of the model is good and the Durbin Watson Value 2.191 represent no serial correlation and no auto correlation in the data. Table II provides the coefficients of the each sectoral indices return and their significance of impact upon the market return. It can be observed that Consumer durables index have a negative coefficient which can be interpreted as the reverse earners to the sensex returns. Technology, oil, capital goods and bank indexes provides a major contribution to the sensex returns. That is the coefficient beta of these sectors reflects the same information. The co-linearity is very low between the all the sectors.

However the Metal and FMCG indices returns have a lower significance on the market index return. Whereas, Infotech and Health care sectoral indices return have been excluded from the regression equation specifying their irrelevance on market index performance.

TABLE III: REGRESSION ANALYSIS LOGARITHMIC STOCK MARKET RETURN (BSE) AS DEPENDENT VARIABLE AND 10 LOGARITHMIC SECTORAL INDICES RETURN AS INDEPENDENT VARIABLES

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
8	.993[h]	.986	.985	.0048092	2.178

TABLE IV: COEFFICIENT OF REGRESSION ANALYSIS LOGARITHMIC STOCK MARKET RETURN (BSE) AS DEPENDENT VARIABLE AND LOGARITHMIC SECTORAL INDICES RETURN AS INDEPENDENT VARIABLES

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
8(Constant)	.000	.000		-.662	.509		
LnCapitalGoods	.148	.012	.191	12.656	.000	.236	4.246
LnOilGas	.230	.012	.269	19.648	.000	.288	3.476
LnTeck	.269	.013	.259	20.900	.000	.352	2.840
LnBankex	.192	.009	.269	20.187	.000	.305	3.284
LnFMCG	.095	.012	.079	8.177	.000	.574	1.742
LnMetal	.044	.009	.071	4.755	.000	.242	4.130
LnConsumer	-.037	.009	-.050	-4.159	.000	.372	2.685
LnAuto	.047	.013	.050	3.621	.000	.288	3.472

Regression is conducted on the logarithmic returns of ten indices considered with logarithmic market index return considered as the dependent variable as in the Table III. R-Square is 98.6% and the fit of the model is good and the Durbin Watson Value 2.178 represents no serial correlation and no auto correlation in the data.

From the Table IV it can be observed that Consumer durables index have a negative coefficient which can be interpreted as the reverse earners to the sensex returns. Technology, oil, capital goods and bank indexes provides a major contribution to the sensex returns. That is the coefficient beta of these sectors reflects the same information. The co-linearity is very low between the all the sectors. However the Metal and FMCG indice have a lower significance on the market index return. Whereas Infotech and Health care indices are again excluded from the regression equation specifying their irrelevance on market index performance. It can be safely concluded that the results are same across both the logarithmic returns and normal return regression equations.

TABLE V: REGRESSION ANALYSIS OF STOCK MARKET RETURNS (BSE) AS DEPENDENT VARIABLE AND 12 SECTORAL INDICES RETURN AS INDEPENDENT VARIABLES

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
8	.995[h]	.991	.990	.0049564	2.311

TABLE VI: COEFFICIENT OF REGRESSION ANALYSIS STOCK MARKET RETURN (BSE) AS DEPENDENT VARIABLE AND 12 SECTORAL INDICES AS INDEPENDENT VARIABLES

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
8(Constant)	.000	.000		-.945	.347		
Bankex	.199	.014	.278	14.400	.000	.227	4.414
OilGas	.258	.016	.304	16.361	.000	.244	4.104
Teck	.261	.016	.248	15.897	.000	.347	2.879
CapitalGoods	.152	.018	.191	8.531	.000	.168	5.963
FMCG	.110	.018	.078	6.236	.000	.533	1.876
Metal	.064	.013	.104	4.783	.000	.178	5.617
HealthCare	-.063	.021	-.045	-3.035	.003	.392	2.551
Consumer	-.033	.014	-.043	-2.399	.018	.266	3.753

Regression is conducted on the returns of twelve indices (power and realty sector included) considered with market index return considered as the dependent variable as provided in the Table V. R-Square is 99.1% and the fit of the model is good and the Durbin Watson Value 2.311 represents no serial correlation and no auto correlation in the data but successive error terms could be negatively correlated.

Consumer durables and Health care indices have a negative coefficient which can be interpreted as the reverse earners to the sensex returns. Technology, oil, capital goods and bank indices returns provides a major contribution to the sensex returns. That is the coefficient beta of these sectoral indices return reflects the same information. The co-linearity is very low between the all the sectors. However the Metal and FMCG indices returns have a lower significance on the market index return. Whereas Infotech, Power, Realty and Auto indices are again excluded from the regression equation specifying their irrelevance on market index performance as observed in Table VI.

Durbin Watson value increases with the inclusion of the two new indexes which could be said as the inclusion of power sectoral index returns explains the sensex return better than without its presence.

On the basis of three previous models the following points could be directly interpreted:

- Different sectoral index returns have varying impact on the market index return
- Health care, consumer durables have providing the negative contribution towards the market index returns.
- Bankex, Oil & Gas, Technology and Capital Goods sectoral indices have been leading contributors towards the market returns.

- Infotech Index return has been irrelevant for the explain ability of the market index return
- Inclusion of power and realty sectoral indices have increased the fitness of model at the same time increased D value, that is introduced negative correlation in the successive error terms

The regression test has been conducted with Market index BSE as dependent variable and each sectoral index as the independent variable.
Equation: BSE_return = a + b * (sectoral_return)
Where:

- a is constant
- b is coefficient of variable
- BSE_return is market index return
- sectoral_return is sectoral index return

The regression testing has been conducted for all the ten sectoral indices individually and there results are tabulated as in Table VII.

TABLE VII: REGRESSION ANALYSIS STOCK MARKET RETURN (BSE) AS DEPENDENT VARIABLE AND EACH SECTORAL INDEX RETURN AS INDEPENDENT VARIABLE IN EACH MODEL

S.No:	Industry Index	R Square	Standardized Coefficient of Variable	Durbin Watson test Value
1	Auto	70.10%	0.838	2.016
2	OilGas	78.50%	0.886	2.236
3	CapitalGoods	78.20%	0.884	2.219
4	Teck	73.40%	0.857	1.985
5	Infotech	46.70%	0.683	1.898
6	HealthCare	50.30%	0.711	2.156
7	FMCG	42.20%	0.649	2.121
8	Bankex	77.90%	0.883	1.964
9	Metal	75.00%	0.866	2.438
10	Consumer	54.60%	0.739	2.254

The following are the vital observations from the testing:

- Oil & Gas, Capital goods, Bankex, Technology could explain the market index return better than the other sectoral index returns
- Metal as an individual has better coefficient than as a group member
- Consumer durables, Health care, Infotech and FMCG has a lower explain-ability of the market index return in concurrence with the previous results
- Auto as an individual index explain the sectoral return but plays a ambiguous role in group member.

ARIMA (Auto Regressive Integrated Moving Average) Modelling

ARIMA modelling is undertaken to understand the ability to forecast the returns on the basis of the movement of the sectoral index returns. It has been conducted in the two broad categories. That is ARIMA (0,1,0) - Random walk model and ARIMA (1,1,0) - Differenced first order auto regressive model

TABLE VIII: RANDOM WALK MODEL ANALYSIS OF 10 SECTORAL INDEX RETURNS W.R.T MARKET INDEX RETURN
MODEL 1 STATISTICS ARIMA (0,1,0)

Model	Number of Predictors	Model Fit statistics		Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	R-squared	Statistics	DF	Sig.	
BSE-Model_1	10	.533	.046	36.102	18	.007	0

The Table VIII presents the information of the random walk model analysis of sectoral index returns w.r.t market index return. This table is generated on the basis of 10 sectoral indices with 5 years data availed. Random walk method generated very low R square value for the model stating that the precision of forecasting of sensex returns is very low.

TABLE IX: DIFFERENCED FIRST ORDER AUTO REGRESSIVE MODEL ANALYSIS OF 10 SECTORAL INDEX RETURNS W.R.T MARKET INDEX RETURN
MODEL STATISTICS ARIMA (1,1,0)

Model	Number of Predictors	Model Fit statistics		Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	R-squared	Statistics	DF	Sig.	
BSE-Model_1	10	.557	.094	19.860	17	.281	0

The Table IX presents the information of the Differenced first order auto regressive model analysis of sectoral index returns w.r.t market index return. This table is generated on the basis of 10 sectoral indices with 5 years data availed. Differenced first order auto regressive model generated very low R square value for the model stating that the precision of forecasting of sensex returns is very low.

TABLE X: RANDOM WALK MODEL ANALYSIS OF 12 SECTORAL INDEX RETURNS W.R.T MARKET INDEX RETURN
MODEL STATISTICS ARIMA (0,1,0)

Model	Number of Predictors	Model Fit statistics		Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	R-squared	Statistics	DF	Sig.	
BSE-Model_1	12	.567	.099	37.942	18	.004	0

The Table X presents the information of the random walk model analysis of sectoral index returns w.r.t market index return. This table is generated on the basis of 12 sectoral indices (inclusion of realty and power indices) with 2 years data availed. R Square is still on lower end that is stating model has lower fitness to the model.

TABLE XI: DIFFERENCED FIRST ORDER AUTO REGRESSIVE MODEL ANALYSIS OF 12 SECTORAL INDEX RETURNS W.R.T MARKET INDEX RETURN

MODEL STATISTICS ARIMA (1,1,0)

Model		Model Fit statistics		Ljung-Box Q(18)			
	Number of Predictors	Stationary R-squared	R-squared	Statistics	DF	Sig.	Number of Outliers
BSE-Model_1	12	.617	.203	24.106	17	.117	0

The Table XI is generated with the help of the 12 sectoral indices for a period of two years. With the inclusion of the power and realty index has increased the fit of the model. That is the R square has increased. ARIMA (1,1,0) differenced first order auto regressive model. The inclusion of the power and realty sectoral indexes has increased the R square value in ARIMA (1,1,0) and the R Squared value has increased from the random walk method. This says that with the sensex returns could be forecasted with the help of the one period lag historic data. With help of the ARIMA models sensex returns could be forecasted for the next period using the previous period data of the sectoral index returns effectively when all the twelve sectoral indices returns are considered.

GARCH (GENERALIZED AUTOREGRESSIVE CONDITIONAL HETEROSKEDASTICITY) MODELLING

GARCH (1,1) test is undertaken to understand the variance of the individual sectoral index and its impact on the market index return.

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j}$$

Is the equation format used

MODEL 1: GARCH, USING OBSERVATIONS 1-272

Dependent variable: BSE

Standard errors based on Hessian

TABLE XII: GARCH (1,1) MODEL WITH STOCK MARKET RETURN AS DEPENDENT VARIABLE AND 10 SECTORAL INDICES RETURN AS INDEPENDENT VARIABLES

	Coefficient	*Std. Error*	*z-stat*	*p-value*	
Const	-0.000575526	0.000283067	-2.0332	0.04203	**
Auto	0.0462931	0.0124177	3.7280	0.00019	***
OilGas	0.239516	0.0117884	20.3180	<0.00001	***
CapitalGoods	0.14569	0.0111761	13.0359	<0.00001	***
Teck	0.247552	0.0268719	9.2123	<0.00001	***
Infotech	0.0145987	0.0188261	0.7754	0.43807	
HealthCare	-0.0188069	0.014133	-1.3307	0.18329	
FMCG	0.0951465	0.0112282	8.4739	<0.00001	***
Bankex	0.1899	0.00919175	20.6599	<0.00001	***
Metal	0.0504284	0.00908555	5.5504	<0.00001	***
Consumer	-0.0317635	0.00883564	-3.5949	0.00032	***
alpha(0)	1.1038e-05	4.71899e-06	2.3391	0.01933	**
alpha(1)	0.129053	0.0726369	1.7767	0.07562	*
beta(1)	0.373557	0.229661	1.6266	0.10383	

Mean dependent var	0.004303		S.D. dependent var	0.039669
Log-likelihood	1074.173		Akaike criterion	-2118.346
Schwarz criterion	-2064.259		Hannan-Quinn	-2096.631

Unconditional error variance = 2.21918e-005

In the stage 1 only ten indices information is undertaken for a previous 272 weekly data. It is then undertaken ARMA (1,1) or GARCH (1,1) test is conducted . Infotech and Health Care indices have insignificant P values. Beta(1) has also insignificant P value where as alpha(1) has significant P value. At the same time alpha(1) has higher value. That is there has significant volatility involved. Since alpha(1) is high and hence volatility in the previous period is going to be present in the current period returns also as observed from the Table XII.

MODEL 2: GARCH, USING OBSERVATIONS 1-118

Dependent variable: BSE

Standard errors based on Hessian

TABLE XIII: GARCH (1, 1) MODEL WITH STOCK MARKET RETURN AS DEPENDENT VARIABLE AND 12 SECTORAL INDICES RETURN AS INDEPENDENT VARIABLES (REALTY AND POWER INCLUDED)

	Coefficient	*Std. Error*	*z-stat*	*p-value*	
const	-0.000814061	0.00039846	-2.0430	0.04105	**
Auto	0.027777	0.0145655	1.9070	0.05652	*
OilGas	0.264486	0.0153388	17.2430	<0.00001	***
CapitalGoods	0.163031	0.0209349	7.7875	<0.00001	***
Teck	0.225887	0.0329052	6.8648	<0.00001	***
Infortech	0.020244	0.0230149	0.8796	0.37907	
HealthCare	-0.0592089	0.0186342	-3.1774	0.00149	***
FMCG	0.098316	0.0162795	6.0392	<0.00001	***
Bankex	0.20377	0.0132983	15.3229	<0.00001	***
Metal	0.0632153	0.0135674	4.6594	<0.00001	***
Consumer	-0.0311538	0.0144295	-2.1590	0.03085	**
Power	-0.0116296	0.0254286	-0.4573	0.64742	
Realty	-0.0087497	0.0101155	-0.8650	0.38705	
alpha(0)	1.59062e-05	8.13827e-06	1.9545	0.05064	*
alpha(1)	0.223835	0.15887	1.4089	0.15886	
beta(1)	1.5158e-012	0.447088	0.0000	1.00000	

Mean dependent var	-0.000299		S.D. dependent var	0.049908
Log-likelihood	471.4306		Akaike criterion	-908.8612
Schwarz criterion	-861.7596		Hannan-Quinn	-889.7366

Unconditional error variance = 2.04933e-005

In the stage 2 all twelve indices information is undertaken for a previous 118 weekly data. It is then undertaken ARMA (1,1) or GARCH (1,1) test is conducted . Infotech, Power and Realty indices have insignificant P values. Beta(1) has also insignificant P value and alpha(1) has also insignificant P value. At the same time alpha(0) has higher value as observed from Table 13. Since alpha(1) is insignificant and hence volatility in the previous period is not going to effect in the current period returns volatility. That is the addition of the power, realty indices has decreased the volatility clustering in the forecasted returns of the market index.

MARKET EFFICIENCY COEFFICIENTS (MEC)

Market efficiency coefficient (MEC) is calculated to understand the liquidity characteristics of the each sectoral indice and market index. At the same time the impact of the liquidity of sectoral indice return on the liquidity of the market index return. Especially with the inclusion of the real and power sectoral indice returns.

MEC = variance of the long term returns / (n * variance of the short term returns)

Where n= number of short terms in one long term

The short term considered in this study is a week and long term consists of four weeks.

The Table XIV provides the details of the Market efficient coefficient of the different sectoral indice and market index.

TABLE XIV: MARKET EFFICIENT COEFFICIENT OF THE DIFFERENT SECTORAL INDICE RETURN AND STOCK MARKET INDEX RETURN

	Phase 1 (3rd December 2004 to 25th February 2010)			Phase 2 (16th November 2007 to 25th February 2010)		
Index	**Short Term Variance**	**Long Term Variance**	**MEC**	**Short Term Variance**	**Long Term Variance**	**MEC**
BSE	0.002	0.006	0.824	0.002	0.014	1.489
Oil&Gas	0.003	0.008	0.742	0.003	0.017	1.216
FMCG	0.001	0.004	0.859	0.001	0.005	1.220
Technology	0.002	0.005	0.812	0.002	0.011	1.344
Bankex	0.004	0.012	0.739	0.005	0.027	1.431
Infotech	0.002	0.007	0.873	0.002	0.015	1.547
Metal Index	0.005	0.019	0.953	0.006	0.041	1.649
Power				0.003	0.022	1.665
Realty				0.011	0.075	1.750
Capital Goods	0.003	0.014	1.023	0.004	0.028	1.811
Auto	0.002	0.008	1.046	0.002	0.019	1.979
Consumer Durables	0.003	0.015	1.174	0.004	0.036	2.147
Health Care	0.001	0.006	1.561	0.001	0.011	2.213

The liquidity as such has increased in phase 2 by an average of 50% in comparison to the phase 1. However the sorted order of sectoral indices on the basis of MEC values has not changed with the change in the phases. That is the liquidity of the health care, consumer durables, auto have been leading in terms of higher liquidity where as oil&gas, FMCG and technology have playing low in liquidity terms. However the volume of turnover would provide a better understanding in the actual liquidity conditions of sectoral indices and market index. At the same time the addition of power and realty had provided increment in the liquidity of the market index as well as the sectoral indices.

The above analysis provides that the inclusion of the health care, consumer durables and the auto sectoral indices would result in the faster changing of the composition of portfolio which is highly required in the formation of tracking indices. Major of the indices sectoral returns have achieved the values of the MEC more than one in the second phase indicating the increment in the variance in the long term than the short term with inclusion of the realty and power sectoral indice returns. These characteristics impact the transaction costs which finally results in the variation of the liquidity of the sectoral indices stocks.

CONCLUSION

The study has attempted to understand the movement of sectoral returns and their contribution towards the sensex returns. The study could find that the sensex returns could be explained with the help of the selected sectoral index returns only. At the same time it has also found that there is significant difference between the different sectors contribution to the final sensex returns. The different phases of the study had resulted in the finding of the difference with inclusion of power and realty sector. The power and realty sector indices have a lower contribution towards the market index returns.

The forecasting of the sensex returns with help of differenced first order regressive method provides better results. It is the time lag which helps in increasing the model fit. At the same time the inclusion of realty and power indices returns also results in increase of fitness of the model of ARIMA. The few peculiar observations made were the health and consumer durable indice returns were earning against the market index returns direction. Whereas Technology, oil, Capital goods and banking remained the main contributing indice returns to the overall market index returns. GARCH models present that there is going to be lower volatility clustering involved with the presence of the realty and power sectoral indice.

The liquidity measured on the basis of Market efficiency coefficients have provided that the sectors like health care, consumer durables and the auto sectoral indices have high long term variance in the returns where as lower in the oil and gas sector. However all the sectoral indices of BSE financial market have more than one as value, indicating the higher long term variance than the short term variance of the sectoral indice. This liquidity characteristic of sectoral indices helps in the optimum formation of the portfolios.

LIMITATIONS

Scope of the study is:

- The time period considered is limited to 5+ years
- The inclusion of the realty and power sector indices are applied in separate phase
- All the sector indices are provided with the same weight-age in the regression equation
- Less number of research papers on the dealing specifically to the sectoral and hence the hypothesis are developed for this particular study.

Limitations of GARCH Model

- GARCH models are parametric specifications that operate best under relatively stable market conditions. GARCH models fail to capture irregular phenomena like wild market fluctuations (e.g., crashes and subsequent rebounds) and other unanticipated events that impact the model undertaken.
- GARCH models fail to fully capture the fat tails observed in asset return series. Heteroscedasticity can explain only a partial of fat tail behaviour.

FUTURE SCOPE

This study has a basic understanding of the sectoral index returns movements and in relation to the sectoral indexes. However further studies can be undertaken with help of the BSE 500 index returns as the market returns. At the same time same could be replicated in the various other financial markets and cross sectional data analysis could be undertaken.

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DATA SET

- http://www.bseindia.com/about/abtip.asp as accessed on March 3rd , 2010
- http://www.google.com/finance?q=INDEXBOM%3A.BSEREAL

SOFTWARE USED

- PASW (SPSS 18)
- GRETL
- Microsoft Excel 2007

APPENDIX

INDEX SPECIFICATION

Index	Base Period	Base Index Value	Date of Launch	Method of Calculation
BSE Auto	01 February, 1999	1000	23 August, 2004	Free-float market capitalization
BSE BANKEX	01 January, 2002	1000	23 June, 2003	Free-float market capitalization
BSE Capital Goods	01 February, 1999	1000	09 August, 1999	Launched on full market capitalization method and effective August 23, 2004, calculation method shifted to free-float market capitalization
BSE Consumer Durables	01 February, 1999	1000	09 Augus, 1999	Launched on full market capitalization method and effective August 23, 2004, calculation method shifted to free-float market capitalization
BSE FMCG	01 February, 1999	1000	09 August, 1999	Launched on full market capitalization method and effective August 23, 2004, calculation method shifted to free-float market capitalization
BSE Healthcare	01 February, 1999	1000	09 August, 1999	Launched on full market capitalization method and effective August 23, 2004, calculation method shifted to free-float market capitalization
BSE IT	01 February, 1999	1000	09 August, 1999	Launched on full market capitalization method and effective August 23, 2004, calculation method shifted to free-float market capitalization
BSE Metal	01 February, 1999	1000	23 August, 2004	Free-float market capitalization
BSE Oil & Gas	01 February, 1999	1000	23 August, 2004	Free-float market capitalization
BSE Power Index	03 January, 2005	1000	09 November, 2007	Free-float market capitalization
BSE Realty	2005	1000	09 July, 2007	Free-float market capitalization

Source: http://www.bseindia.com

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