Asian Journal of Empirical Research
Volume 7, Issue 7(2017): 147-159

http://aessweb.com/journal-detail.php?id=5004

Exploring relation between Indian market sentiments and stock market returns

Divya Aggarwal

Doctoral Student (Finance), XLRI – Xavier School of Management, India
Email address: *fb14007@astra.xlri.ac.in* (Corresponding author)

Corresponding author

ARTICLE HISTORY:

Received: 27-07-2017
Accepted: 27-09-2017
Online available: 10-07-2017

Keywords:
sentiments,
market mood index,
VIX,
stock returns,
granger causality

ABSTRACT

This paper aims to understand the relation between contemporaneous stock market returns and investor sentiments in Indian context. The analysis is done for daily data over a range of five years. Market measure proxies of investor sentiments including the market mood index and the volatility index are examined to explore their nature of association with the stock market returns. The results show that changes in sentiments have a higher explanatory power than sentiments at level when determining statistically significant relation with stock market returns. While the market mood index indicating optimism is positively related with stock returns, the VIX index also referred to as the fear guard index has a negative relation with stock returns. Moreover the market mood index seems to granger cause stock market returns and exhibit a long run association with stock market returns. With presence of sentiments impacting stock market returns established, more studies in context of developing countries are needed to understand the temporal dynamics between sentiments and stock markets.

Contribution/ Originality
The current study examines the relationship between daily Indian contemporaneous stock market returns and investor sentiments over a time frame of five years. It had used two indices named market mood index and volatility index as proxies of investor sentiments to represent both optimism and fear in the market.

DOI: 10.18488/journal.1007/2017.7.7/1007.7.147.159
ISSN (P): 2306-983X, ISSN (E): 2224-4425

Citation: Divya Aggarwal (2017). Exploring relation between Indian market sentiments and stock market returns. Asian Journal of Empirical Research, 7(7), 147-159.

1. INTRODUCTION

History of stock markets is full of events with dramatic price movements which have become debatable topics for scholars and practitioners (Baker and Wurgler, 2006). Behavioral finance studies started getting attention in the 1980s as the classical theory of efficient market hypothesis (EMH) failed to explain excess volatility in the markets (Shiller *et al.*, 1984). During the 1980s, scholars from the behavioral finance school of thought tested the market mispricing in various ways. The focus of the studies was to explain and predict stock market movement which could not be justified solely by economic fundamental fluctuations. The studies left the role of sentiments as implicit (Baker and Wurgler, 2007). In 1990s the focus shifted to analyzing the role of investor sentiments (IS) in predicting stock market movements. The market mispricing was attributable to two assumptions. First was the noise trader approach, consisting of investors subjected to having sentiments and acting on noise in various forms of uncertainty (Shleifer and Summers, 1990). The first formal theory in this area was by (De Long *et al.*, 1990) named as DSSW theory, followed by (Barberis *et al.*, 1998) who developed an IS model focusing on earnings forecast belief formation. The second assumption was the limit to arbitrage by rational traders who are unable to correct the prevailing mispricing due to various costs (Shleifer and Vishny, 1997).

Majority of the studies on IS are concentrated on developed markets, primarily US followed by developed European countries. With ease of data availability on small investors, high involvement of individual in stock market activity and assumption of small investors as noise traders, the proxies for IS studies on US markets, have focused on explaining and predicting stock markets by analyzing individual retail investor behavior (Kling and Gao, 2008). The robustness of IS proxies developed for US market needs to be examined in markets of developing countries characterized by different investor profile (Finter *et al.*, 2012). Being a developing economy, Indian capital markets have different characteristics compared with developed markets like US. With a period of reforms starting in 1991 through liberalization, globalization and privatization (LPG) policy, the markets went through reformatory changes to come at par with other developed markets. With a history of scams and insider trading, Indian individual retail investors have shied away from investing in capital markets (Das and Pattanayak, 2013). It is the foreign institutional investors (FIIs) who have a dominant role, almost 70%, in capital market activity in India (Nayyar, 2015). The wide disparity in the stock market movement and increasing interest of FIIs in Indian markets urges the need to analyze factors contributing to capital market movements. Factors like dominance of few players, excess volatility and lack of clarity on regulatory provisions have also impacted functioning of Indian capital markets (Das and Pattanayak, 2013). With lack of comprehensive studies in analyzing investor behavior in India, it is difficult to comment on the exact nature of the factors leading to change in investor attitudes. The biggest impediment in analyzing sentiments is the lack of a well-defined proxy to measure sentiments in Indian context. Since the sentiments are not directly observable, it remains a question of whether it is optimism or fear which impacts the markets.

This study contributes to the existing literature of relation between IS and stock markets, by utilizing two Indian sentiment measures to reflect both optimistic and pessimistic sentiments. The study has used the volatility index (VIX) and a recently developed aggregate sentiment index called market mood index (MMI) for the analysis. The need and motivation for this study is driven to examine the impact of sentiments on stock returns so as to understand Indian capital market behavior. Moreover, inadequate studies in Indian context make it more imperative to analyze investor behavior so that policy makers can understand investor concerns.

The study shows that IS have a statistically significant relation with stock market returns. Changes in VIX have a higher explanatory power for contemporaneous stock returns in comparison to changes in MMI. However, MMI granger causes stock market returns and exhibited a long run association with stock market returns.

The article is structured as follows. Section 2 discusses a brief literature on the measures of sentiments and prominent studies in this area. Section 3 mentions the data sourced. Section 4 discusses the methodology adopted and the analysis done, followed by the conclusion in Section 5.

2. LITERATURE REVIEW

With the establishment of presence of IS impacting stock markets, two prominent approaches developed to measure IS. First was the bottom up approach, which empirically examined the impact of sentiments on aggregate stock prices. The second was the top down approach which examined the characteristics of stocks most subjected to sentiments (Baker and Wurgler, 2006).

Due to an imprecise and abstract construct of sentiment, the research in measuring sentiments is subjected to a lot of controversy (Qui, 2004). Over the last fifteen years, three types of measures have developed to measure IS including market based measures, direct survey methods and sentiment analysis. This paper is not a comprehensive review of the available measures of investor sentiment proxies but briefly summarizes only the indirect market measure and direct survey method proxies of IS.

The market based measures are an indirect way of measuring sentiments. Measures like closed end fund discount (Lee *et al.*, 1991); IPO returns and volume (Ritter, 1991), (Cornelli *et al.*, 2006); net mutual fund redemption (Neal and Wheatley, 1998), (Brown *et al.*, 2003), (Frazzini and Lamont, 2006) and dividend premium (Baker and Wurgler, 2004) fall under the market based measures. Another branch of market based measures focused on direct equity market measures like market liquidity (Baker and Stein, 2004), put call volume trading ratio (Wang *et al.*, 2006), buy sell imbalance ratio (Kumar and Lee, 2006) and total equity issues to overall total issues (Baker and Wurgler, 2000). However, these measures failed to give consistent results and were categorized as more of a data mining exercise (Qiu and Welch, 2004). To overcome the limitation and controversies of individual market measure proxies, (Baker and Wurgler, 2006) developed a composite sentiment index to measure IS. They identified six proxies of IS which could explain the variation in stock returns. Their approach of developing a composite index has been adopted in many studies including those of (Chen *et al.*, 2010), (Finter *et al.*, 2012) and (Chen *et al.*, 2014) for developed markets of US, Hong Kong, Germany, France, Canada, Japan etc. Apart from the composite sentiment index, market performance indices have also developed to measure IS. Prominent among them are bearish sentiment index (Solt and Statman, 1988), ARMS index (Wang *et al.*, 2006) and volatility index called as VIX (Baker and Wurgler, 2007). These empirical studies have exhibited an agreement of a relationship between sentiments and returns. With pessimistic sentiments, the returns show a negative association and with optimistic sentiments they exhibit a positive association.

However, due to the controversies and lack of consistent results, a direct approach of measuring sentiments known as the survey approach also developed. The survey approach enabled to measure direct response to a set of questions pertaining to a specific variable. Prominent surveys being used in US studies are the American association of individual investors (AAII) and investors Intelligence (II) as IS proxies to predict stock market movement (Brown and Cliff, 2004), (Zwergel and Klein, 2006), (Verma and Verma, 2008), (Verma and Soydemir, 2009) along with Michigan consumer confidence survey (Qiu and Welch, 2004). Another survey being widely used is sentix representing responses of German stock market participants (Schmeling, 2007), (Heiden *et al.*, 2013) and (Bormann, 2013). However the survey approach is subjected of not being able to capture true behavior as the survey response and actual trading behavior might be different. Moreover, how representative the survey participants are of the target investors being surveyed is also a major limitation.

Some studies have developed a composite index with a combination of direct and indirect measures (Finter *et al.*, 2012).With both the measures being widely used as IS proxies and giving mixed results, it becomes difficult to define which measure is the most accurate measure. Moreover both the

measures pose challenges of implementing in different geographies with unique investor profiles and demographics.

In Indian context, there is no unique well-defined composite index for measuring sentiments. Few studies have tried to build composite sentiment index following the (Baker and Wurgler, 2007) approach but have given mixed results. Prominent studies among them are (Chandra and Thenmozhi, 2013), (Kumari and Mahakud, 2015), and (Dash and Dash, 2016). With FIIs dominating the Indian capital markets, survey based measures do not provide a sound approach of measuring sentiments (Kumari and Mahakud, 2015). Hence this study has not used survey based measures as proxies of IS. To examine the relationship between sentiments and return empirically, volatility index (VIX) and a recently developed composite index by ETNOW and small case called market mood index (MMI) are used in this study.

Based on the existing theory of IS having an association with returns, this study examines below aspects:

1. Contemporaneous relation of current stock market returns and IS
2. Nature of causality between current stock returns and IS
3. Temporal dynamics between current stock returns and IS

The methodology and the components of the index are mentioned in the next section describing the data variables.

3. DATA

Daily data for stock market returns and proxies for IS are taken over the sample period of 13th March 2012 till 31st January 2017 to empirically test the hypothesis. Below is the explanation of the variables taken.

3.1. Returns of stock markets (Dependent Variable)

For analyzing stock market returns, the returns of the national stock exchange (NSE) are examined in the study. NSE is India's largest and the first demutualized stock exchange. The benchmark index is the Nifty 50 consisting of 50 stocks covering over 13 sectors. It is calculated as a free float market capitalization weighted index. The study has also considered the industry specific stock indices along with value weighted stock indices to examine impact of investor sentiment on them. The industry specific indexes include automobile, pharmaceutical, consumption and fast moving consumer goods. Nifty midcap and small cap are the value weighted indexes being used. The returns are defined as: $r_t = Ln\left(\frac{P_t}{P_{t-1}}\right) * 100$.

3.2. Sentiment proxies: The variables taken for measurement of sentiment index are defined below

3.2.1. MMI composite index

It is a composite index developed by ETNOW and small case (ETNOW, 2017) and is sourced directly from the experts who have developed the index. The index is computed by taking seven components including net open interest of FIIs in index futures, implied volatility of one month Nifty options, skewness by difference between implied volatilities of Nifty over the market put and call options, momentum of Nifty index, modified arms index, price strength and the demand for gold. To construct the index, the components are normalized on a scale of 0-100 and given equal weights. An index value of below 50 indicates fear whereas an index value of above 50 indicates greed.

3.2.2. VIX

Studies on developed markets have established a significant relation between volatility index (VIX) and returns. When examined in Indian context (Bagchi, 2012), similar results were obtained. It is

considered as an investor fear guard for US markets and when examined maintained the same status for BRIC countries (Sarwar, 2012). Studies have shown that VIX and index returns are inversely related. With ease of data availability and a proxy of sentiments, it can help explain the role of IS in Indian stock markets. The data on Indian VIX is sourced from the NSE website available on a daily basis. It is reported in percentage basis and reflects the near term market expectations.

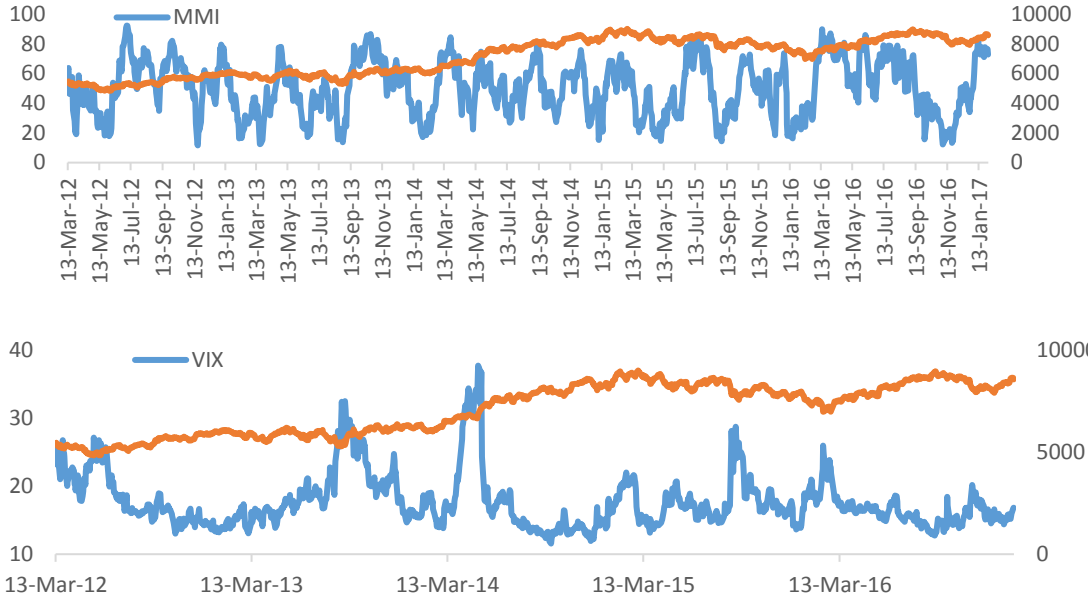

Figure 1a and 1b: Co-movement of Nifty with the IS proxies

Source: NSE website, MMI website
Source: NSE website

From the figures it can be seen that Nifty and MMI have a positive co movement whereas Nifty and VIX seem to have an inverse relation. The descriptive statistics for the stock returns and IS proxies are given in Table 1 below.

Table 1: Descriptive Statistics of index returns and IS proxies

Returns	Nifty	Auto	Cons	FMCG	Pharma	Small cap	Midcap	VIX	MMI	ΔVIX	ΔMMI
Mean	0.04%	0.07%	0.06%	0.06%	0.06%	0.05%	0.06%	17.68	50.09	0.10%	1.10%
Median	0.04%	0.12%	0.09%	0.13%	0.11%	0.19%	0.19%	16.71	50.64	-0.35%	0.17%
Min	-6.10%	-7.53%	-6.17%	-4.76%	-7.24%	-11.22%	-9.18%	11.57	11.58	-33.92%	-57.00%
Max	3.74%	5.81%	4.63%	5.37%	4.98%	6.41%	4.34%	37.71	92.17	64.36%	76.63%
SD	0.01	0.01	0.01	0.01	0.01	0.01	0.01	3.97	18.58	0.05	0.15
Skew	(0.33)	(0.27)	(0.50)	(0.28)	(0.58)	(1.07)	(0.94)	1.74	-0.04	1.90	0.93
Kurtosis	5.26	5.17	6.35	5.29	6.41	9.08	7.88	6.71	2.03	24.44	6.80
JB	278.63 (0.00)	251.52 (0.00)	616.73 (0.00)	279.72 (0.00)	655.79 (0.00)	2092.40 (0.00)	1379.17 (0.00)	1306.8 (0.00)	47.51 (0.00)	23885.6 (0.00)	904.48 (0.00)
ADF	-32.01 (0.000)	-31.38 (0.000)	-31.18 (0.000)	-33.57 (0.000)	-32.41 (0.000)	-29.24 (0.000)	-30.87 (0.000)	-4.417 (0.00)	-6.18 (0.00)	-26.95 (0.000)	-11.89 (0.000)

Examining the returns statistics, the Nifty index has generated on an average, daily return of 0.04% with the maximum daily loss of 6.1% and gain of 3.7% during the time period examined. All the index

returns have negative skewness which reflect that the data series are asymmetrically distributed with longer tail towards the left. The high kurtosis also supports the asymmetry of the distribution having fat tails. Moreover, the p values of the Jarque bera test statistic for normality reject the null hypothesis of a normal distribution. The ADF (with trend and intercept) test results in rejection of the null hypothesis of data series having unit root. Hence, the return series are stationary at level. The IS series are stationary at level also.

To understand if there is any relation between IS proxies and the stock returns, a correlation matrix is constructed to check for preliminary analysis. While MMI is a positive indicator for current stock returns, VIX index indicate fear and are negatively related to current stock returns. Table 2 below shows the correlation matric with Part A showing the correlation between level series and Part B between changes in series.

Since MMI is a positive indicator and VIX is a fear indicator, they have a positive and negative correlation with the index returns respectively at both level and change series.

Table 2: Correlation matrix between stock returns and IS proxies

a. Sentiment at level

	MMI	VIX	Nifty Returns
MMI	1.00	-0.20	0.14
VIX	-0.20	1.00	-0.06
Nifty Returns	0.14	-0.06	1.00

b. Changes in Sentiment

	ΔMMI	ΔVIX	Nifty Returns
ΔMMI	1.00	-0.36	0.54
ΔVIX	-0.36	1.00	-0.55
Nifty Returns	0.54	-0.55	1.00

Though the correlation of Nifty returns is less with IS proxies, it is high with changes in IS proxies. The next section, explains the methodology in empirically examining the relationship between returns and IS proxies.

4. METHODOLOGY AND ANALYSIS

The method of ordinary least squares (OLS) is employed to perform the empirical analysis of examining the relationship between stock market returns and IS. Newey West standard error method in OLS is used to deal with autocorrelation and heteroscedasticity. Below equation is tested using Eviews software.

$$R_t = \alpha + \beta * Sentiment_t + \varepsilon_t \quad \text{..... (1)}$$

$$R_t = \alpha + \beta * Change\ in\ Sentiment_t + \varepsilon_t \quad \text{.....(2)}$$

Where R_t is the return at month t, $Sentiment_t$ is the value of the sentiment proxy at time t, $change\ in\ Sentiment_t$ is the value of the change in sentiment proxy at time t, and ε_t is the error term. The equations 1 and 2 are examined separately so as to understand which equation has a higher explanatory power. The study has not included the impact of other macro variables to examine the relation between stock returns and IS proxy for two reasons. Firstly, the sentiment proxies taken reflect the feeling of optimism and pessimism among the investors. The market measures of sentiment proxies taken indirectly capture the influence of macro factors as well. Secondly, since the study is performed on daily frequency data, there is limitation of daily macro data availability for the analysis.

4.1. Current stock return and sentiment relationship

With graphical and correlation evidence in favor of stock return and sentiment relationship, the formal analysis of analyzing the strength of the association is done through regression analysis. Table 3 shows the regression analysis with the dependent variable as returns and independent variable as MMI and VIX separately. Equation 1 with MMI and VIX as independent variables is examined in Part A and B. Equation 2 with changes in MMI and VIX as independent variables is examined in Part C and D.

Table 3: Regression results: Dependent Variable - returns

Dependent Variable	Nifty	Auto	Cons	FMCG	Pharma	Small cap	Midcap
Part A – MMI							
Constant	-0.3378 (0.0000)	-0.4628 (0.0000)	-0.3474 (0.0001)	-0.1980 (0.0322)	-0.0902 (0.3518)	-0.7494 (0.0000)	-0.5707 (0.0000)
Sentiment	0.0075 (0.0000)	0.0106 (0.0000)	0.0080 (0.0000)	0.0051 (0.0014)	0.0030 (0.0834)	0.0159 (0.0000)	0.0125 (0.0000)
R^2	0.0208	0.0270	0.0281	0.0075	0.0026	0.0525	0.0453
Adj R^2	0.0200	0.0262	0.0273	0.0067	0.0018	0.0517	0.0445
AIC	2.7529	3.1834	2.5922	3.0272	3.0146	3.3041	2.9709
Wald F stat	31.6183 (0.0000)	34.3745 (0.0000)	30.4664 (0.0000)	10.3200 (0.0013)	3.0022 (0.0834)	55.1526 (0.0000)	55.9669 (0.0000)
DW stat	1.8587	1.8316	1.8188	1.9399	1.8601	1.7133	1.8143
Part B – VIX							
Constant	0.3089 (0.0149)	0.4468 (0.0354)	0.4009 (0.0177)	0.3103 (0.0640)	0.4427 (0.0052)	0.4077 (0.0600)	0.4548 (0.0177)
Sentiment	-0.0152 (0.0290)	-0.0212 (0.0861)	-0.0194 (0.0508)	-0.0141 (0.1434)	-0.0215 (0.0153)	-0.0201 (0.1146)	-0.0225 (0.0458)
R^2	0.0039	0.0049	0.0074	0.0026	0.0061	0.0038	0.0067
Adj R^2	0.0031	0.0041	0.0065	0.0017	0.0053	0.0030	0.0058
AIC	2.7700	3.2058	2.6133	3.0322	3.0111	3.3542	3.0106
F stat	4.7766 (0.0290)	2.9514 (0.0860)	3.8237 (0.0507)	2.1434 (0.1434)	5.8949 (0.0153)	2.4926 (0.1146)	3.9974 (0.0457)
DW stat	1.823	1.7906	1.7748	1.9244	1.8547	1.6468	1.7516
Part C - Δ in MMI							
Constant	0.0004 (0.9851)	0.0311 (0.3094)	0.0271 (0.2474)	0.0367 (0.2193)	0.0369 (0.2396)	0.0029 (0.9366)	0.0138 (0.6207)
Changes in Sentiment	0.0348 (0.0000)	0.0358 (0.0000)	0.0278 (0.0000)	0.0211 (0.0000)	0.0222 (0.0000)	0.0438 (0.0000)	0.0390 (0.0000)
R^2	0.2942	0.2009	0.2190	0.0834	0.0939	0.2591	0.2888
Adj R^2	0.2936	0.2002	0.2183	0.0827	0.0931	0.2585	0.2882
AIC	2.4255	2.9865	2.3735	2.9476	2.9187	3.05818	2.6764
F stat	214.006 (0.0000)	130.864 (0.0000)	166.553 (0.0000)	59.0277 (0.0000)	85.9012 (0.0000)	190.706 (0.0000)	215.320 (0.0000)
DW stat	2.0703	1.9531	1.9557	1.9849	1.9349	1.7856	1.9603
Part D - Δ in VIX							
Constant	0.0485 (0.0530)	0.0809 (0.0127)	0.0660 (0.0078)	0.0669 (0.0299)	0.0679 (0.0361)	0.0632 (0.1022)	0.0674 (0.0265)
Changes in Sentiment	-0.1009 (0.0000)	-0.1079 (0.0000)	-0.0858 (0.0000)	-0.0720 (0.0000)	-0.0679 (0.0000)	-0.1248 (0.0000)	-0.1100 (0.0000)
R^2	0.3046	0.2249	0.2564	0.1193	0.1081	0.2597	0.2840
Adj R^2	0.3041	0.2243	0.2558	0.1186	0.1074	0.2591	0.2834
AIC	2.4105	2.9560	2.3244	2.9076	2.9028	3.0573	2.6832
F stat	193.730 (0.0000)	151.277 (0.0000)	148.236 (0.0000)	49.6135 (0.0000)	53.6285 (0.0000)	143.843 (0.0000)	191.381 (0.0000)
DW stat	1.7121	1.7360	1.7058	1.8744	1.8450	1.5353	1.6308

The results for IS proxies at level show a positive relation of stock returns with MMI and a negative relation with VIX. The sentiment variables at level and at changes, are significant in explaining stock market returns. However, the Adj R^2 is more for changes in IS proxies more than IS proxies at level. It shows that changes in sentiments explain stock returns with a higher power as compared to sentiments at level. The Adj R^2 is higher for changes in VIX than MMI for explaining the relation with stock market.

For changes in MMI, which shows optimism in the market, the model equation exhibits an Adj R^2 of 29% with Nifty index. For all the sectors, sentiment variable is positive and statistically significant. It shows that the current market returns increase with increase in sentiments. Sectors like automobile and consumption depicted through auto and consumption index also show a significant Adj R^2 of over 20%. For sectors like FMCG and Pharma, though the sentiment variable is significant but the Adj R^2 is low. The reasons can be attributable to the nature of FMCG sector which is non speculative in nature and pharma sector which is highly regulated. Examining the value weighted indexes of small cap and mid cap indexes, the sentiment variable is significant with a high Adj R^2 of 25.8% and 28.8% respectively.

For changes in VIX, which also demonstrates investor fear, the sentiment variable exhibits a negative statistical significant relation. Changes in VIX give a higher explanation as the Adj R^2 is higher. The reasons could be attributable to fear and pessimism impacting investor behavior more than optimism.

4.2. Granger causality

The regression results have given evidence in favor of a statistically significant relationship between market returns and changes in sentiments. However, they are silent on explaining the nature of causality between the two. For that, granger causality tests provide a simple tool to examine the nature of dependence between stock returns and IS. For running the granger causality tests, the data series should be stationary. The ADF unit root test, with trend and intercept showed evidence of returns and level series of IS proxies to be stationary. The null hypothesis in granger causality tests are that the series do not granger cause each other. The null hypothesis is tested using the F statistic. When the p values is less than 5%, the null hypothesis is rejected. Table 4 below shows the granger causality tests with lag period of 2 days.

Table 4: Granger causality results

Panel a – Sentiment level and stock returns			
MMI	**F-stat**	**VIX**	**F-stat**
NIFTY_R does not Granger Cause MMI	82.4070 (2.E-25)	NIFTY_R does not Granger Cause VIX	3.6668 (0.0258)
MMI does not Granger Cause NIFTY_R	0.5824 (0.5587)	VIX does not Granger Cause NIFTY_R	4.6221 (0.0100)
AUTO_R does not Granger Cause MMI	42.235 (2.E-18)	AUTO_R does not Granger Cause VIX	1.3260 (0.2659)
MMI does not Granger Cause AUTO_R	0.3240 (0.7232)	VIX does not Granger Cause AUTO_R	1.8177 (0.1628)
CONSUMPTION_R does not Granger Cause MMI	46.564 (3.E-20)	CONSUMPTION_R does not Granger Cause VIX	3.0658 (0.0470)
MMI does not Granger Cause CONSUMPTION_R	0.0368 (0.9638)	VIX does not Granger Cause CONSUMPTION_R	1.3586 (0.2574)
FMCG_R does not Granger Cause MMI	19.2587 (6.E-09)	FMCG_R does not Granger Cause VIX	1.9766 (0.1390)
MMI does not Granger Cause FMCG_R	0.4946 (0.6099)	VIX does not Granger Cause FMCG_R	1.6658 (0.1895)
PHARMA_R does not Granger Cause MMI	21.9771 (4.E-10)	PHARMA_R does not Granger Cause VIX	6.2969 (0.009)

MMI does not Granger Cause PHARMA_R	1.3183 (0.2680)	VIX does not Granger Cause PHARMA_R	0.6448 (0.5249)
SMALLCAP_R does not Granger Cause MMI	60.0303 (1.E-25)	SMALLCAP_R does not Granger Cause VIX	6.9960 (0.0010)
MMI does not Granger Cause SMALLCAP_R	0.9214 (0.3982)	VIX does not Granger Cause SMALLCAP_R	4.3355 (0.0133)
MIDCAP_R does not Granger Cause MMI	59.6460 (2.E-25)	MIDCAP_R does not Granger Cause VIX	8.4295 (0.0002)
MMI does not Granger Cause MIDCAP_R	0.7427 (0.4760)	VIX does not Granger Cause MIDCAP_R	3.1754 (0.0421)
MMI does not Granger Cause VIX	3.3392 (0.0358)	MMI_CHANGE does not Granger Cause VIX_CHANGE	1.5433 (0.2141)
VIX does not Granger Cause MMI	30.6031 (1.E-13)	VIX_CHANGE does not Granger Cause MMI_CHANGE	32.0253 (3.E-14)*

The results of granger causality give interesting insights for both the IS proxies. With respect to the MMI proxy, the null hypothesis of stock returns do not granger causing MMI is failed to be rejected. However, the null hypothesis of MMI do not granger causing stock market returns is rejected since the p values are above 5%. It can be observed that sentiments do effect stock market returns.

Similarly examining the VIX proxy, contrasting results were obtained. The null hypothesis of Nifty returns and VIX not granger causing each other is failed to be rejected since the p value is less than 5%. Similar results were obtained for value weighted indexes of small cap and mid cap stocks. However, this result does not hold for other index returns and the tests show inconclusive results. The null hypothesis of no granger causality of VIX with automobile, consumption, fmcg and pharma sectorial indices is rejected as the p value is more than 5%. The null hypothesis of no granger causality of index returns with VIX is rejected for only automobile and fmcg sectorial indices.

Apart from the nature of causality and association between market returns and sentiments, it is also necessary to understand the nature of temporal relations between the series.

4.3. Temporal association between stock returns and sentiment measures

With the nature of causation examined, this section explores the temporal dynamics with long and short run causality between the data series. All the stock market index value are non-stationary at level (Results shown below), but there logarithm difference i.e. return series of the stock market index values are stationary. Hence all the stock market index values are integrated of the same order i.e. I(1). However, the sentiment proxy series are not stationary at level and integrated of order I (0). Since the stock market index series and IS proxy index series are not integrated of the same order, Johansen cointegration tests cannot be used. To analyze the long term temporal dynamics, auto regression distributed lag (ARDL) technique is used since the series are integrated of order I (1) and 1(0). The ARDL tests are done on three data series. For sentiment proxy, MMI and VIX are used whereas for stock market series only Nifty index is taken to examine the relation. The optimal lag length is selected directly using ARDL method of regression in Eviews.

The equation for the ARDL regression equation is given below:

$$Log(Nifty)_t = \alpha_0 + \alpha_1 Log(Nifty)_{t-1} + \alpha_2 Log(Nifty)_{t-2} + \alpha_3 Log(Nifty)_{t-3} + \alpha_4 Log(Nifty)_{t-4} + \beta_1 Log(MMI)_{t-1} + \beta_2 Log(MMI)_{t-2} + \beta_3 Log(MMI)_{t-3} + \beta_4 Log(MMI)_{t-4} + \varepsilon_t$$

$$Log(Nifty)_t = \alpha_0 + \alpha_1 Log(Nifty)_{t-1} + \alpha_2 Log(Nifty)_{t-2} + \alpha_3 Log(Nifty)_{t-3} + \alpha_4 Log(Nifty)_{t-4} + \beta_1 Log(VIX)_{t-1} + \beta_2 Log(VIX)_{t-2} + \beta_3 Log(VIX)_{t-3} + \beta_4 Log(VIX)_{t-4} + \varepsilon_t$$

	MMI	VIX
$\alpha_1 Log(Nifty)_{t-1}$	0.9671 (0.0000)	1.1213 (0.0000)
$\alpha_2 Log(Nifty)_{t-2}$	0.0322 (0.4909)	-0.1214 (0.0000)
$\alpha_3 Log(Nifty)_{t-3}$	-0.1088 (0.0178)	
$\alpha_4 Log(Nifty)_{t-4}$	0.1085 (0.0008)	
$\beta_1 Log(Sentiment)$	0.0455 (0.0000)	-0.1043 (0.0000)
$\beta_1 Log(Sentiment)_{t-1}$	-0.0606 (0.0000)	0.1044 (0.0000)
$\beta_2 Log(Sentiment)_{t-2}$	0.0348 (0.0000)	
$\beta_3 Log(Sentiment)_{t-3}$	-0.0215 (0.0000)	
$\beta_4 Log(Sentiment)_{t-4}$	0.0042 (0.0243)	
R-sq.	0.9982	0.9980
Adj R-sq.	0.9982	0.9980

The model selection has used 4 lag structure with Hannan Quinn criteria. The selected model criteria is ARDL (4, 4) for Equation 1 and ARDL (2, 2) for Equation 2. Below chart in Figure 2 shows the model selection summary with Hannan Quinn criteria graph. The lower the value, the better is the model. The top two models have 4 lags in the dependent variable for Equation 1 and 2 lags in dependent variable for Equation 2.

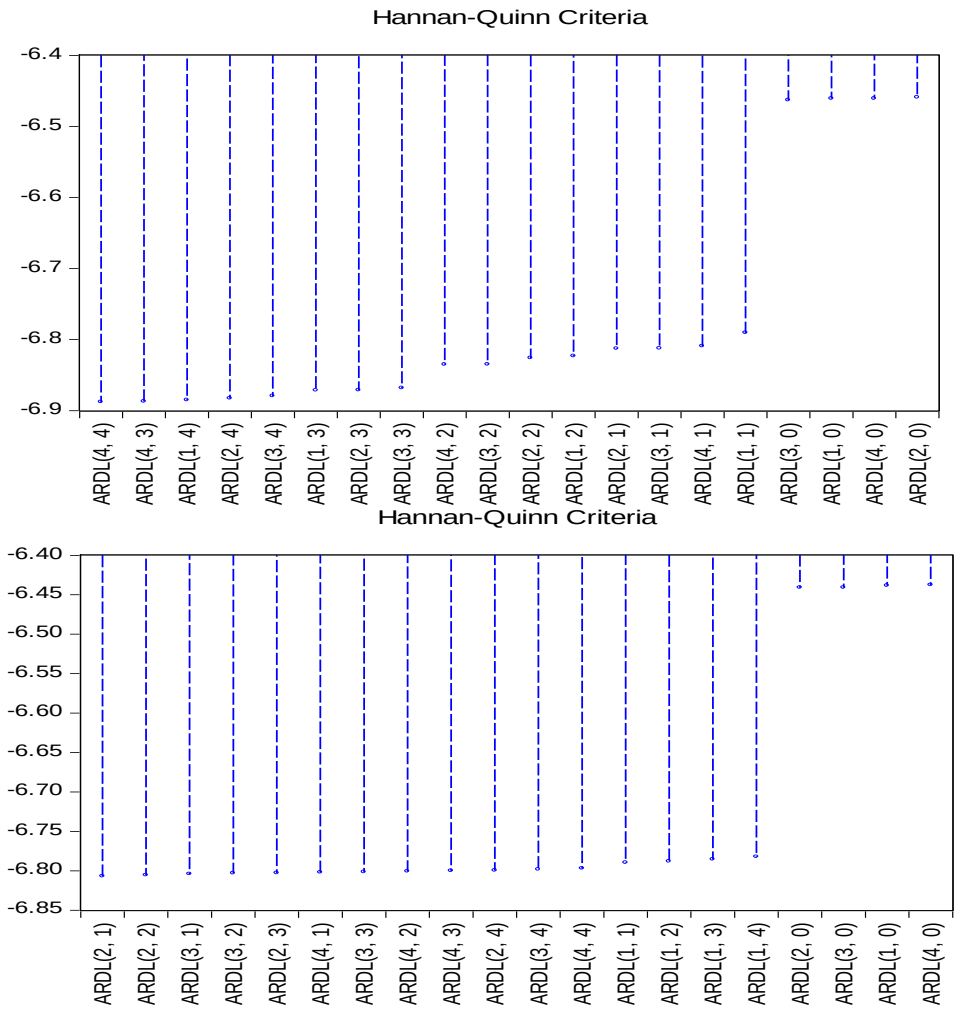

Figure 2: Hannan Quinn criteria graph

The cointegration and long run relationships defined by the ARDL estimates can be checked by using Bound test based on the Pesaran, Shin and Smith model. The null hypothesis of the bound test is that there is no long run association between the market index and sentiment measure. If the value of F statistic is below the upper and lower value of the bound test Pesaran critical values, then the null hypothesis is failed to be rejected. The results of the bound test are given in table 5 below.

Table 5: Bound test result

Bound test	MMI		VIX	
F statistic	10.5591		0.7864	
Significance level	**Lower Bound**	**Upper Bound**	**Lower Bound**	**Upper Bound**
1%	4.81	6.02	4.81	6.02
5%	3.15	4.11	3.15	4.11
10%	2.44	3.28	2.44	3.28

Since the F statistic value is above the Pesaran critical values for Equation 1, it seems that MMI and Nifty index have a long run relation. However, the null hypothesis of no long run cointegration is failed to be rejected for Equation 2. VIX and stock market index do not have a long run association.

5. CONCLUSION

This study aims to explain the relationship between IS and stock market returns. The study is unique in two ways. Firstly it uses a different IS proxy for measuring optimism which is developed using equal weights. Secondly it uses daily data frequency in analyzing nature of IS and their relation with stock market returns. Most of the studies have used monthly data due to data constraints. The analysis in the study have exhibited IS having a significant relation with stock market returns. MMI index has a statistically significant positive relation whereas VIX has a statistically significant negative relation with stock market returns. Examining the nature of relation between IS and stock market returns, further analysis of granger causality and temporal dynamics have given interesting results. While MMI does clearly granger causes returns of all stock market indices examined under study, VIX gave mixed results. Moreover, only one way causality was observed with sentiments granger causing returns and not the other way around. Examining the nature of temporal dynamics, MMI exhibited a long run association with stock market returns using the ARDL bound test. VIX measure showed no long term association with stock market returns. The results of the study offer scope for future studies. With presence of significant and long run association of MMI with stock market, future studies can be done to explore the forecasting ability of IS on stock market returns. Moreover, profitable trading strategies can be devised based on IS.

Funding: This study received no specific financial support.
Competing Interests: The author declares that s/he has no conflict of interests.
Contributors/Acknowledgement: The study would not have been possible without the support of the creators of Small case Market mood index who agreed to share the data.

References

Bagchi, D. (2012). Cross-sectional analysis of emerging market volatility index (India VIX) with portfolio returns. *International Journal of Emerging Markets, 7*(4), 383-396. *view at Google scholar* / view at publisher

Baker, M., & Stein, J. (2004). Market liquidity as a sentiment indicator. *Journal of Financial Markets, 7*(3), 271-299. *view at Google scholar* / view at publisher

Baker, M., & Wurgler, J. (2000). The equity share in new issues and aggregate stock returns. *The Journal of Finance, 55*(5), 2219-2257. *view at Google scholar* / view at publisher

Baker, M., & Wurgler, J. (2004). A catering theory of dividends. *The Journal of Finance, 59*(3), 1125-1165. *view at Google scholar* / view at publisher

Baker, M., & Wurgler, J. (2006). Investor sentiment and the cross-section of stock returns. *The Journal of Finance, 61*(4), 1645-1680. *view at Google scholar* / view at publisher

Baker, M., & Wurgler, J. (2007). Investor sentiment in the stock market. *The Journal of Economic Perspectives, 21*(2), 129-151. *view at Google scholar* / view at publisher

Barberis, N., Shleifer, A., & Vishny, R. (1998). A model of investor sentiment. *Journal of financial economics, 49*(3), 307-343. *view at Google scholar* / view at publisher

Bormann, S. (2013). *Sentiment indices on financial markets: What do they measure?* Economics Discussion Papers, (No. 2013-58). *view at Google scholar*

Brown, G., & Cliff, M. (2004). Investor sentiment and the near-term stock market. *Journal of Empirical Finance,* 11(1), 1-27. *view at Google scholar* / view at publisher

Brown, S., Goetzmann, W., Hiraki, T., Shirishi, N., & Watanabe, M. (2003). *Investor sentiment in Japanese and US daily mutual fund flows.* National Bureau of Economic Research., No. w9470. *view at Google scholar* / view at publisher

Chandra, A., & Thenmozhi, M. (2013). *Investor sentiment, volatility and stock return comovements*. Available at SSRN. doi: http://dx.doi.org/10.2139/ssrn.2353073.

Chen, H., Chong, T., & Duan, X. (2010). A principal-component approach to measuring investor sentiment. *Quantitative Finance, 10*(4), 339-347. *view at Google scholar* / view at publisher

Chen, H., Chong, T., & She, Y. (2014). A principal component approach to measuring investor sentiment in China. *Quantitative Finance, 14*(4), 573-579. *view at Google scholar* / view at publisher

Cornelli, F., Goldreich, D., & Ljungqvist, A. (2006). Investor sentiment and pre-IPO markets. *The Journal of Finance, 61*(3), 1187-1216. *view at Google scholar* / view at publisher

Das, N., & Pattanayak, J. (2013). The effect of fundamental factors on Indian stock market: a case study of Sensex and nifty. *IUP Journal of Applied Finance, 19*(2), 84-99. *view at Google scholar*

Dash, S., & Dash, S. (2016). Does investor sentiment as conditioning information help to explain stock returns behaviour? A test of alternative asset pricing models. *Review of Behavioral Finance, 8*(2), 174-198. *view at Google scholar* / view at publisher

De Long, J., Shleifer, A., Summers, L., & Waldmann, R. (1990). Noise trader risk in financial markets. *Journal of political Economy, 98*(4), 703-738. *view at Google scholar* / view at publisher

ETNOW (2017). *Market mood index*. Retrieved on May 20, 2017, from http://mmi.smallcase.com/.

Finter, P., Niessen-Ruenzi, A., & Ruenzi, S. (2012). The impact of investor sentiment on the German stock market. *Journal of Business Administration, 82*(2), 133-163. *view at Google scholar* / view at publisher

Frazzini, A., & Lamont, O. (2006). The earnings announcement premium and trading volume. NBER working paper, 13090. *view at Google scholar* / view at publisher

Heiden, S., Klein, C., & Zwergel, B. (2013). Beyond fundamentals: investor sentiment and exchange rate forecasting. *European Financial Management, 19*(3), 558-578. *view at Google scholar* / view at publisher

Kling, G., & Gao, L. (2008). Chinese institutional investors' sentiment. *Journal of International Financial Markets, Institutions and Money, 18*(4), 374-387. *view at Google scholar* / view at publisher

Kumar, A., & Lee, C. (2006). Retail investor sentiment and return Comovements. *The Journal of Finance, 61*(5), 2451-2486. *view at Google scholar* / view at publisher

Kumari, J., & Mahakud, J. (2015). Does investor sentiment predict the asset volatility? Evidence from emerging stock market India. *Journal of Behavioral and Experimental Finance, 8*, 25-39. *view at Google scholar* / view at publisher

Lee, C., Shleifer, A., & Thaler, R. (1991). Investor sentiment and the closed-end fund puzzle. *The Journal of Finance, 46*(1), 75-109. *view at Google scholar* / view at publisher

Nayyar, D. (2015). *Bloomberg View*. Retrieved March 18, 2017, from https://www.bloomberg.com/view/articles/2015-04-09/india-stock-rally-needs-more-domestic-retail-investors.

Neal, R., & Wheatley, S. (1998). Do measures of investor sentiment predict returns? *Journal of Financial and Quantitative Analysis*, *33*(04), 523-547. *view at Google scholar* / view at publisher

Qiu, L., & Welch, I. (2004). *Investor sentiment measures.* National Bureau of Economic Research, No. w10794. *view at Google scholar* / view at publisher

Ritter, J. (1991). The long-run performance of initial public offerings. *The journal of finance*, *46*(1), 3-27. *view at Google scholar*

Sarwar, G. (2012). Is VIX an investor fear gauge in BRIC equity markets? *Journal of Multinational Financial Management*, *22*(3), 55-65. *view at Google scholar* / view at publisher

Schmeling, M. (2007). Institutional and individual sentiment: Smart money and noise trader risk? *International Journal of Forecasting*, *23*(1), 127-145. *view at Google scholar* / view at publisher

Shiller, R. J., Fischer, S., & Friedman, B. M. (1984). Stock prices and social dynamics. *Brookings Papers on Economic Activity*, *2*, 457-510. *view at Google scholar*

Shleifer, A., & Summers, L. (1990). The noise trader approach to finance. *The Journal of Economic Perspectives*, *4*(2), 19-33. *view at Google scholar* / view at publisher

Shleifer, A., & Vishny, R. (1997). The limits of arbitrage. *The Journal of Finance*, *52*(1), 35-55. *view at Google scholar* / view at publisher

Solt, M., & Statman, M. (1988). How useful is the sentiment index? *Financial Analysts Journal*, 45-55. *view at Google scholar* / view at publisher

Verma, R., & Soydemir, G. (2009). The impact of individual and institutional investor sentiment on the market price of risk. *The Quarterly Review of Economics and Finance*, *49*(3), 1129-1145. *view at Google scholar* / view at publisher

Verma, R., & Verma, P. (2008). Are survey forecasts of individual and institutional investor sentiments rational? *International Review of Financial Analysis*, *17*(5), 1139-1155. *view at Google scholar* / view at publisher

Wang, Y., Keswani, A., & Taylor, S. (2006). The relationships between sentiment, returns and volatility. *International Journal of Forecasting*, *22*(1), 109-123. *view at Google scholar* / view at publisher

Zwergel, B., & Klein, C. (2006*). On the predictive power of sentiment-why institutional investors are worth their pay*. Available at https://ssrn.com/abstract=965890.