Predictive Ability of IVIX & Its Relation with Stock Market Returns

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Abstract:- India volatility index, IVIX captures behavioral and psychological aspects of traders. The purpose of introducing IVIX is to avail new instrument for trading and hedge through it. It is believed that investors perception about the Nifty 50 in near term can be indicated using IVIX. Here an attempt is made to understand the relation between IVIX and market return using t –Test for r. The study also aims to understand the predictive ability of IVIX using t – test for slope, which can be helpful to the investors to take the decision. The study provided sufficient evidence that stock market returns are negatively associated with the Volatility Index. The negative correlation prevailing between IVIX and NIFTY 50, would give an opportunity to investors to use IVIX as a directional tool to know the future movement in NIFTY 50. The t – Test for slope finds that there is significant relationship between IVIX and NIFTY50 which implies that predictive ability of IVIX is high.

I. INTRODUCTION

Volatility Index (VIX) was discussed for the first time in paper by Prof. Robert E Whaley of Duke University, US in 1993. In the same year Chicago Board Options Exchange (CBOE) became the first exchange in the world to introduce a volatility index and named it VIX. In 1994, German Futures and Options Exchange (GFOE) introduced an implied volatility index with name (VDAX).

Volatility index was introduced in India on March 2008, which is named as (IVIX) India volatility index that captures behavioral and psychological aspects of traders. The purpose of introducing IVIX is to avail new instrument for trading and hedge through it. VIX has been considered by many to be the world's premier barometer of investor sentiment. Volatility Index (VIX) is a symbolic indicator to manage the risk in financial markets. It provides an understanding of the volatility in the options markets.

Volatility Index is a measure of market expectation of volatility over the near term. A higher volatility means that a security's value can potentially vary over a large range of values. This means that the price of security can change dramatically. A lower volatility means that a security's value does not fluctuate dramatically, but change in value at a steady pace over a period of time. The variance in returns also

known as volatility, is by its very nature stochastic, that indicate the stock market perceived volatility over a period of time. VIX is of great advantage in the functions like trading, hedging, analyzing and introducing derivatives products in Index.

Investors perception about the index in near term can be indicated using IVIX. It is understood that volatility index will increase when the market price of the index moves abruptly up or down. If there is no abrupt change in the price of market index eventually option prices decreases which results in decrease in volatility index. Here an attempt is made to understand the relation between IVIX and market return and predictive ability of IVIX using statistical tools.

II. OBJECTIVES

- To study about volatility index as tool of risk management.
- To identify whether there is any relation between IVIX and NIFTY 50.
- To examine the predictive ability of IVIX.

III. NEED FOR THE STUDY

VIX is an emerging concept in Indian stock market. Volatility index captures the behavioral and psychological aspects of traders in stock market. Investors perception about the index in near term can be indicated using IVIX. It is understood that volatility index will increase when the market price of the index moves abruptly up or down. If there is no abrupt change in the price of market index eventually option prices decreases which results in decrease in volatility index. Here an attempt is made to understand the relation between IVIX and market return using statistical tools. There is need to understand the predictive ability of IVIX which can be helpful to the investors to take the decision. Investors can use VIX to predict future movement in NIFTY 50, as the volatility index measures the expected volatility in a given market over a 30-day period. An increase in the volatility index alarms the market, since an increase in volatility index means an increase in uncertainty, which results in discomfort for most market

participants.

IV. RESEARCH HYPOTHESIS

H_0 = There is no significant relationship between IVIX and NIFTY50.

H_1= There is significant relationship between IVIX and NIFTY50.

V. SCOPE OF THE STUDY

The study is conducted to understand the extent of relation between India VIX and NIFTY50. Daily closing values of IVIX and NFTY50 were taken to calculate return for the period from April 1st 2012 to March 31st 2017. Standard Deviation and Mean Returns are calculated to know volatility and returns in both the indices. Coefficient of correlation is estimated to know the relation between IVIX and Nifty 50. T-test is carried out to understand the significance of relation.

VI. RESEARCH METHODOLOGY

Daily returns of IVIX and Nifty 50 are calculated using daily closing values for period of 5 years that is from April 1st 2012 to March 31st 2017. Mean, Standard Deviation and Beta are estimated using excel. Correlation is estimated to understand the relation prevailing between IVIX and NIFTY50 and r square to know the strength of relation. Two tailed t test for slope is carried out to know the significance of relationship between IVIX and NIFTY50.

VII. LITERATURE REVIEW

Pierre Giot (2005) investigated on two closely related topic that dealt with the empirical link between implied volatility indexes and stock index returns 1) the contemporaneous relationship between relative changes in implied volatility and stock market returns, and 2) the possible relationship between implied volatility and future stock market returns. Study also focused on the "does fear mean opportunity" question in examining possible trading gains for long positions triggered by very high levels of the implied volatility index. The extent of this asymmetric effect depends on the period. The increase in implied volatility when negative stock index returns occur is somewhat lower in high volatility trading environments than in low-volatility periods; the converse is true for a decline in implied volatility.

R. Palaniswamy, K. Lakshminarayanan, V. Venkatesh V (2009) found that the ultimate purpose of introducing IVIX is to avail new instrument for trading on it and hedge through it. It can also be used to predict the change in near month. The primary objective of the research was to find the extent of relationship prevailing `between market and volatility indices. The data collected from NSE, from November 2007 to February 2009, is analyzed using correlation and it resulted in r value of -0.677 which infers 3 VIX contract is necessary to

hedge two Nifty contracts. When Indian option market is effectively traded then the correlation between two indices will improve and it will definitely provide reliable reading of market sentiment in future. In future sector specific volatility indices could be constructed to enable hedging in respective sectors.

S. S. S. Kumar (2010) examined the behavior of India's volatility index (IVIX) that was launched in 2008. By using linear regressions, autoregressive models and unit root tests, the study tries to empirically answer whether IVIX reflects certain characteristics known as stylized facts of volatility. The results of the study showed that the volatility index reproduces almost all the stylized facts such as volatility persistence, mean reversion, negative relationship with stock market movements and positive association with trading volumes has straddles need to be adjusted frequently as prices move else they become directional bets. This study showed a negative relationship between IVIX and NIFTY returns which will be quite beneficial to investors, as including IVIX may lead to diversification benefits to investors.

M. Thenmozhi1 and Abhijeet Chandra (2013) examined whether India VIX represents the true underlying risk aversion of investors in the Indian stock market. Essentially, India VIX documents the level of market anxiety during the ups and downs of the stock market, and it would provide useful benchmark information in assessing the degree of market turbulence being experienced. The annualized volatility measure seemed to be better performing, but only in explaining the standard deviations of the Nifty returns; for the other measures of realized volatility, the India VIX captured returns volatility better than any other measures. Our results demonstrate a statistically significant negative relationship between the stock market returns and volatility. When the market took a sharp downward turn, the relationship was not as significant for the higher quantiles. This attribute of the India VIX makes it a viable risk management tool—derivative products based on the volatility index can be used as portfolio insurance against worst declines.

Devanshi Barbhaya, Kinjal Bhadani, Nikshubha Goswami, Hetal Mistri, Arpita Patel (2014) examined the preliminary analysis of data set which suggests that volatility in the Indian stock market is time varying in nature, persist to form clusters and has a long memory process. Volatility in the Indian stock market is time varying in nature, persist to form clusters and has a long memory process. In general, regarding the impact of derivatives on stock market volatility, index futures alone have led to a increase in volatility in the expected pries and also help in price discovery by improving the information efficiency.

Gurmeet Singh (2015) provided evidence of time varying, nature of stock volatility in India. Investors aim to invest with higher profitable and less risky investment. Therefore they need to study and analyze stock market volatility among many

other factors, before making investment decisions. These results might be largely attributed to the existence of substantial speculative trading, low level of market depth and price limits observed in the Indian market.

Surya Bahadur G. C. Ranjana Kothari (2016) examined the relationship between India VIX and volatility in the Indian stock market. India VIX is a volatility index based on the index option prices of Nifty. This study examined the daily VIX and CNX Nifty Index volatility data for the 5-year period between 2009 and 2014. The study examines the relationship of India VIX with stock market return and volatility. India VIX has negative relationship with market index and return. The Indian stock market goes down when volatility is high. Market returns are higher during low volatility periods and vice-versa. There is existence of dynamic interrelationship and lead-lag interactions between India VIX and stock market volatility.

Sankarshan Basu, Arup Halder, Chandra Prakash Tiwari studied on merits and demerits of the volatility index (VIX).While measuring the implied volatility in the market ,the VIX is also a great tool for hedging in times of financial distress. It also helps traders in cases of expected volatility in market. The primary focus here is the Indian stock market and the benefit of VIX to stakeholders in the Indian markets. The introduction of trading in VIX index will enable active management of risks that cannot be hedged. The regulator will allow the trading in index as well when the market participants will become comfortable with the index.

Gangineni Dhanaiah, D Raghunath Reddy, T N L Prasad investigated the contemporaneous negative and asymmetric relationship between Volatility Index – Market return. It is found that there exists a 12 significant inverse relation between movements in India VIX and movements in NIFTY. Further, the results suggest that relation between rates of change in the India VIX and asymmetric and statistically significant. Thus India VIX acts as a measure of investors fear of the downside as international studies establish. This contemporaneous negative asymmetric relationship can be utilized for hedging purpose by market participants.

VIII. ANALYSIS OF EXTENT AND STRENGTH OF RELATIONSHIP BETWEEN IVIX AND NIFTY 50

Table 1: Calculated Values for IVIX and Nifty 50

Calculated Values for FY 2012-13						
INDEX	Mean ($\bar{x}$)	SD(σ)	SE	Beta(β)	r	r^2
IVIX	-0.0394	4.1992	0.2667			
NIFTY50	0.3007	0.8166	0.0518	-0.08	-0.45	0.20

Calculated Values for FY 2013-14						
INDEX	Mean ($\bar{x}$)	SD(σ)	SE	Beta(β)	r	r^2
IVIX	-0.2762	5.0866	0.3225			
NIFTY50	0.0711	1.1424	0.0724	-0.11	-0.51	0.26

Calculated Values for FY 2014-15						
INDEX	Mean ($\bar{x}$)	SD(σ)	SE	Beta(β)	r	r^2
IVIX	0.0081	5.4720	0.3518			
NIFTY50	0.1003	0.8636	0.0555	-0.06	-0.41	0.17

Calculated Values for FY 2015-16						
INDEX	Mean ($\bar{x}$)	SD(σ)	SE	Beta(β)	r	r^2
IVIX	0.2371	6.5434	0.4181			
NIFTY50	-0.0366	1.0847	0.0693	-0.11	-0.69	0.48

Calculated Values for FY 2016-17						
INDEX	Mean ($\bar{x}$)	SD(σ)	SE	Beta(β)	r	r^2
IVIX	-0.0421	4.3699	0.2781			
NIFTY50	0.0733	0.7842	0.0499	-0.11	-0.59	0.35

Analysis of t – Test for Correlation

Table 2: 't - Test for r at 5% significance'

t – Test Statistics	FY 2012-13	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17
	7.95	9.46	6.98	14.18	11.42
H_0	Rejected	Rejected	Rejected	Rejected	Rejected
H_1	Accepted	Accepted	Accepted	Accepted	Accepted

Interpretation:

At 5% level of significance, the critical value using t distribution is lesser than the computed value. There is significant relationship between IVIX and Nifty 50 all the five financial years. This implies that when the volatility of IVIX is high, there is instability in NIFTY50 index.

Analysis of t – Test for Slope

Table 3: Regression statistics for FY 2012-13

Multiple R	0.4525
R Square	0.2048
Adj R Square	0.2015
Standard Error	0.7312
	248

ANOVA								
	df	SS	MS	F	Signi F			
Regression	1	33.8738	33.8738	63.356	6.3443			
Residual	246	131.525	0.5346					
Total	247	165.399						
	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	0.0266	0.0464	0.5729	0.5671	-0.0648	0.118	-0.05	0.1032
IVIX RETURN	-0.088	0.011	-7.9596	6.3443	-0.1097	-0.0662	-0.1062	-0.0697

Table 4: Regression statistics for FY 2013-14

Multiple R	0.5155
R Square	0.2657
Adjusted R Square	0.2628
Standard Error	0.9828
Observations	250

ANOVA								
	df	SS	MS	F	Signi F			
Regression	1	86.7286	86.7286	89.775	2.2363			
Residual	248	239.584	0.966					
Total	249	326.313						
	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	0.1031	0.0622	1.6566	0.0988	-0.0194	0.2257	0.00035	0.2059
IVIX RETURN	-0.1157	0.0122	-9.4749	2.2363	-0.1398	-0.0917	-0.1359	-0.0956

Table 5: Regression statistics for FY 2014-15

Multiple R	0.4109				
R Square	0.1688				
Adjusted R Square	0.1653				
Standard Error	0.7906				
Observations	242				
ANOVA					

	df	SS	MS	F	Signi F
Regression	1	30.4752	30.4752	48.755	2.8247
Residual	240	150.016	0.625		
Total	241	180.491			

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	0.1008	0.0508	1.9853	0.0482	0.0007	0.201	0.0169	0.1848
IVIX RETURN	-0.0648	0.0092	-6.9824	2.8247	-0.0831	-0.0465	-0.0801	-0.0495

Table 6: Regression statistics for FY 2015-16

Multiple R	0.6941				
R Square	0.4818				
Adjusted R Square	0.4796				
Standard Error	0.784				
Observations	245				
ANOVA					

	df	SS	MS	F	Signi F
Regression	1	138.912	138.912	225.96	1.4913
Residual	243	149.388	0.6147		
Total	244	288.3			

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	-0.0052	0.0501	-0.1045	0.9168	-0.1039	0.0935	-0.088	0.0775
IVIX RETURN	-0.115	0.0076	-15.0319	1.4913	-0.1301	-0.0998	-0.1277	-0.1024

Table 7: Regression statistics for FY 2016-17

Multiple R	0.5895				
R Square	0.3476				
Adjusted R Square	0.3449				
Standard Error	0.636				
Observations	247				
ANOVA					

	df	SS	MS	F	Signi F
Regression	1	52.8074	52.8074	130.55	1.6189
Residual	245	99.1028	0.4045		
Total	246	151.91			

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	0.0688	0.0404	1.7015	0.0901	-0.0108	0.1485	0.002	0.1356
IVIX RETURN	-0.1058	0.0092	-11.4258	1.6189	-0.124	-0.0875	-0.121	-0.0905

Table 8: 't – test for Slope at 5% significance'

t – Test Statistics	FY 2012-13	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17
	-7.62	-9.48	-7.04	-15.3	-11.5
H_0	Rejected	Rejected	Rejected	Rejected	Rejected
H_1	Accepted	Accepted	Accepted	Accepted	Accepted

Interpretation:

At 5% level of significance, the critical value using t distribution is lesser than the computed value.There has been significant relationship between IVIX and NIFTY50 at 5% level of significance, though in the negative direction. This implies that predictive ability of IVIX is significant.

IX. FINDINGS

The empirical data analysis provided adequate evidence that stock market returns are negatively associated with the India Volatility Index. IVIX provides a reliable estimate of the expected short-term stock market volatility, which is a vital piece of information for investment decisions such as asset allocation and hedging risks. India VIX is used as a great tool for hedging risky positions in a fluctuating stock market.

In FY 2012-13 and FY 2016-17, IVIX gave a –Ve return & NIFTY50 gave +Ve return. In FY 2015-16, IVIX gave a +Ve return where as NIFTY50 gave -Ve return. In FY 2013-14 and FY 2014-15, IVIX and NIFTY50 gave +Ve returns.

It is estimated that, there is difference between standard deviation of IVIX and NIFTY50. They are not equal. The IVIX standard deviation from the mean is high in the year 2013-14, 2014-15 and 2015-16. It shows that they have not been stable because there has been high volatility.

It is noticed that in FY 2012-13 (r = -0.45), FY 2013-14 (r = -0.52), FY 2014-15 (r = -0.41) and FY 2016-17 (r = -0.60), there is a moderate negative relationship between IVIX and NIFTY 50. In FY 2015-16 (r = -0.70), there is a strong negative relationship between IVIX and NIFTY 50. Hence it is understood that the negative correlation prevailing between IVIX and NIFTY 50, would give an opportunity to investors to use IVIX as a directional tool to know the future movement in NIFTY 50.

There has been significant relationship between IVIX and NIFTY50 though in the negative direction, at 5% level of significance. This implies that when the volatility of IVIX is high, there is instability in NIFTY50 index. This is an important tool to alert the investors.

The IVIX aims to track the market expectation of volatility, giving an indication about how market could react in future. It reflects investors' view of future expected stock market volatility. When the VIX level is low, it implies that investors are optimistic rather than fearful in the market, which indicates that investors perceive low potential risk.

X. CONCLUSION

Investors perception about the index in near term can be indicated using IVIX. The empirical data analysis provided adequate evidence that stock market returns are negatively associated with the Volatility Index. IVIX provides a reliable estimate of the expected short-term stock market volatility, which is a vital piece of information for many investment decisions such as asset allocation and hedging risks. India VIX is used as a great tool for hedging risky positions in a fluctuating stock market.

The negative correlation prevailing between IVIX and NIFTY 50, would give an opportunity to investors to use IVIX as a directional tool to know the future movement in NIFTY 50. From t- Test it is found that there is significant relationship between IVIX and NIFTY50 though in the negative direction, at 5% level of significance. This implies that when the volatility of IVIX is high, there is instability in NIFTY50 index.

At 5% level of significance, the critical value using t distribution is lesser than the computed value. From the t – Test for slope it is found that there is significant relationship between IVIX and NIFTY50 at 5% level of significance, though in the negative direction. This implies that predictive ability of IVIX is high.

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