



Detection of Rational Bubble in Indian Banking Sector: An in depth Study on S&P BSE BANKEX

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ABSTRACT: *The world of valuation has various dimensions. The asset price bubble or the financial plays an important role in impacting the valuation of any stock. When there is a presence of any type of bubble in the market especially in stock it can either drives the some stocks or sometimes it even manipulated the value of the entire index which gives false valuation to any investor. Most of the times this bubble is formed due to herd behaviour and cognitive bias which are concepts taken from the behavioural finance. This study is conducted empirically on the sectorial index S&P BSE BANKEX on the onset of 2008 global crisis and concludes recently to detect the indirect evidence of asset price bubble. In investment finance, identification of abnormal/ unusual deviation and movement of asset prices in a rapid manner over a relatively short span of time, without giving adequate time to disperse the information in a systematic manner is very crucial. This study extends Caspi, Itamar's study which was done in year 2013 on the US market i.e. S&P 500, then extended by Ghosh, Bikramaditya in 2016 in Indian context on CNX Nifty using three advanced form of Augmented dickey fuller Test (such as RADF, SADF and GSADF simultaneously) and investigates its validity in Indian banking industry which is represented by sectorial index named BANKEX. This study will also through an interesting aspect of banking index along with spotting of herding behaviour during the global crisis, post the financial cyclones and during the recovery phase extended till now.*

Keywords: *bubble, ADF, RADF, SADF, BANKEX, Herding.*

I. INTRODUCTION

Bubble has always been coined as a term in financial vocabulary, when the price of any asset rises beyond their true value bubble starts forming. It can develop in an economy, securities, stock market, real estate etc. it causes investor eager to pursue profits beyond reasonable level of return. Bubble continues to grow until prices rise beyond the certain level, and then the bubble bursts and prices start falling. So therefore identifying bubble is an important task which saves time, energy of the investor. When bubble is forming resources flow towards the area of rapid growth and when the bubble burst resources move away causing prices to deflate. When assets behave in such manner where its prices move up in less period of time and move down in short period from their mathematical valuation point, such phenomenon flip the market upside down. This often comes because of tendency or evidence of herding behaviour in the market. Such moves in the market or in the economy are termed as "destabilizers". These are called destabilizers because they put the structural break in the time series, moreover they increase the opportunity cost of investor at rapid pace. Such structural break happens when the big bullies or the giant FIIs or may be DII. Entry of such big giants in the market creates such a shock. The impact of such shock depends upon the magnitude and repetitiveness. When such shocks happen in short period of time it is a signal of approaching bear or possible avalanches breakdown in the bourses or in the commodity market.

In context of bubble formation and bubble burst behavioural finance play a vital role. There are two important concepts in behavioural finance in relation to bubble formation and collapse. First is herding, in which a group of people either follow a financial guru, or any eminent fund manager. As a result there is a sign of overconfidence, these people take decision based on their guts rather than calculation based decision. As a result it leads to social distortion wrong judgement and formation of general opinion. If we explain it in simple terms such as irrationality are visible effect of cognitive bias. A phenomenon can be well explained by these aspects, however their quantification become more important, as the prediction of future in relation to such incidents saves the public money entering and exiting the bourses at the crucial point of time.

In the study which is done by Garber (2000), he suggested that the bubble as the part of price movement of the economic assets which cannot be justified by rational valuation theories. Similar study which was conducted by Barlevy in 2007, it explains that bubble may be defined or termed as the phase of the assets when the prices of the assets are in a unidirectional manner and it exceeds the valuation of assets to a large extent short span of time. In our case we have taken the Indian market which is an ideal example of weak efficient economy, distortion of information, wrong decisional judgement. Moreover the herding phenomenon is frequently observed in the market. As a result it becomes the necessity of the situation that we should conduct an in-depth investigation on such an important aspect of Indian economy and its market.

II. LITERATURE REVIEW

There had been a lots of study in this field. There are many researchers who had found and report an extraordinary event while spotting the bubble formation the stock market or any other same type of time series which are stochastic in nature along with the drift. A study in this context which was done by Fama in 1965 has stated that as per efficient market hypothesis there is no phenomena named bubble. As per him no bubble can exist. But as the time progress with the increase in the study in this field during past four decade had proved such claim false. If we go further in history one more similar study done by Keynes in 1936 much before Fama's study, he predicted about existence of bubble and provides rationality for the same with the irrationality of investor when they are trading or dealing in stock market. One more study which was given by Evans in 1991 which tells about the theory of periodically collapsing bubble. As more people start doing study on bubble as a result more arguments starts among different research scholar. In case of the study which was conducted by Brunnermeier and Abreru in year 2003, he argued that bubbles emerge but not on irrationality when dealing in stock market, it occurs on wrong pricing of assets. One common thing among all the above mentioned study is that none of them had investigated the reason for the formation of bubble nor they investigated about the time of bubble formation in the market when it becomes evident or its presence can be felt in the market to everybody. With the increase in momentum in the study some researcher like Jarrow, Protter and Shimbo in 2007 they all state that derivatives can be used in detecting bubble by using it against the underlying assets. Major shortfall in this claim and study was that the researcher has restriction on boundaries and there was lack of empirical evidence support for such claim. During 1980s the first bubble test was administered named "variance bounds tests". This test was administered and constructed by Shiller and Leroy and porter.

In this test calculation for prediction of the rational value of stock is done in accordance to the present value of the dividend which is already paid to the holder. In this test if output shows that the rational price is less than the actual price then there is presence of bubble is there and it indicates that prices are not realistic. But there is some criticism against this test which was raised by Flavin in 1983 and Kleidon in 1986. They both stated that there is biasness towards terminal value and small sample which hampers the reliability of the study. As time passes more test was done on bubble testing by using different tools. One among this was a test which was conducted by Diba and Grossman in 1988; they make use of stationarity as a toll for bubble detection. This model was based upon future value. It takes into consideration expected future stock price, future dividend and some unobserved variable. Although this study was criticized by Gürkaynak in 2008, it was clearly evident that when the data sets were large in number and spread over a vast period of time, the outcome will be accurate. In 1987 a new equation named ARIMA was introduced by West. As compare to other methods he comes with relatively simple method in which he regressed current stock price on lagged dividend by making use of discount rate and it leads to generation new equation named ARIMA as output of study. But two gaps areas were pointed by Gürkaynak. He states that only past dividends are taken into consideration and non-stationary cannot be detected with high precision even if it is present. To fill this gap this study was extended by Froot and Obstfeld's in 1991, taking into consideration of dividend payment again; however the result was differentiated between rational bubble and intrinsic bubble because of their uniqueness in their model. In accordance to Gürkaynak the model should be linear in nature but as the log dividend are taken into study so therefore model is coming out non-linear. Moreover when this model was used by Ma and Kanas by taking into consideration data set of long period from US capital market over a century, the result of forecasting the stock price were reasonably good with high degree of accuracy. In 1993 study done by Hall and Sola was unique in itself. For the first time they introduced the check of stationarity and they also extended the augmented Dickey Fuller test in order to check whether the stock price some stationary pattern or are tending towards mild explosive pattern. All other test which were conducted in the same domain were not generating effective result in short run but they are effectively predicting the past bubble with greater degree of accuracy. In 2011 Phillips, Wu and Yu had introduced supremum ADF or SADF test to determine bubble with greater degree of accuracy. They all extended this study further and in year 2013 they all came up with generalized SADF for efficient bubble prediction. Moreover in the same direction Taipalus used unit root test and its rolling version i.e. RADF with the help of Monte Carlo simulation on the US stock market data in year 2012, where he came to conclusion that there is presence high signals of bubble which is coming up well before 12 months. Sornette et al in year 2010

had combined the conventional rational theory of finance with the behavioural theory in order to study and analyse the two collapses in Chinese stock exchange market indexes i.e. SSE and SZSE within the time period starting from year 2005 to year 2009 by making use of LPPL i.e. Log- periodic power law. However this toll was amended by Sornette and Zhou to incorporate the fundamental economic factors in 2006 such as interest rate, spreads, exchange rate and historical volatility which helps in defining the proof of herding. Caspi in year 2013 extended both hall and sola model and Katja Taipalus model further and effectively come up with new model. He used standard ADF, rolling window ADF, Supremum ADF (SADF) and Generalized SADF

Test 1	confidence level	t-statistics	Prob*	occurrence
ADF		-2.410938	62.5%	37.5%
test critical values	99%	-0.435358		
	95%	-0.975615		
	90%	-1.226218		
Test 2	confidence level	t-statistics	Prob*	occurrence
MaxRADF		0.586369	34.5%	65.5%
test critical values	99%	-0.273067		
	95%	-0.908627		
	90%	-1.222767		
Test 3	confidence level	t-statistics	Prob*	occurrence
SADF		0.704142	5.2%	94.8%
test critical values	99%	1.260984		
	95%	0.714456		
	90%	0.438775		

where rejection of null hypothesis in every case means and create evidence or the empirical proof of the existence of an asset price bubble. Similarly Korkos in 2014 has used GSADF and RADF model to test in US capital market and found the trace of bubble ,both collapse and on-going. In year 2016 Ghosh, Bikramaditya conducted the similar study as of Caspi and extend it and do the in-depth analysis of CNX – nifty. He conducted four test using ADF, max RADF, SADF and GSADF. Result of this entire test fails to reject null hypothesis, therefore it states that there is presence of asset price bubble in CNX nifty.

III. RESEARCH METHODOLOGY

The equation use in the study is as follows:

$$y(t) = \mu + \delta y(t - 1) + \sum_{i=1}^p \varphi_i \Delta y(t - i) + \varepsilon(t)$$

Y(t) is the daily closing price of the sectorial index BANKEX, μ is the intercept, p is the maximum number of lags, φ is the differentiated lag coefficient for “I” lags and ε is the error term. The work has been conducted over the full dataset from 02/04/2007 to 30/06/2016. There are sample size was 2293 which are included in dataset for analysis for the mentioned period. Every dataset constitutes of tiny samples of 109 in each window of sample.

Three tests were conducted and taken into consideration namely augmented dickey fuller test (ADF), SADF, maxRADF. All test are different right tail variation of the well know Augmented Dickey Fuller test for stationarity. RADF test is a rolling regression test performed on subsequent sub- samples of the main samples with the rolling forward initialization. Every sub-sample is finite and fixed. Moreover the detection of bubble entirely dependent on the fact related to sub-sample. Therefore sample size should be optimum in order to determine bubble detection with high accuracy. SADF method is recursive in nature. Recursive means that the solution of a bigger problem is combination of the solution of the smaller problem that constitutes and contributes towards bigger problem. Supremum augmented dickey Fuller test has an important factor named “supremum ρ in the singular form” that is the least upper bound in a partially ordered set (taken from concept of mathematics). The generalized version of SADF is GSADF that has been conducted by Phillips, Shi and Yu in 2012, which observes the possibility of periodically collapsing bubble.

Hypothesis setting:

H0: $\delta=1$ and Ha: $\delta>1$. So the H0 confirms that the, linear stochastic time series has unit root, therefore it is non-stationary in nature and Ha confirms that the time series is stationary in nature, in fact it is said to have mildly explosive autoregressive coefficients. So, if the P value is lower than 5%, Ho is rejected and thus the evidence of a price bubble will be evident. On the contrary if the P value is higher than 5%, then H0 is accepted thus evidence of price bubble is termed to be absent.

Study output

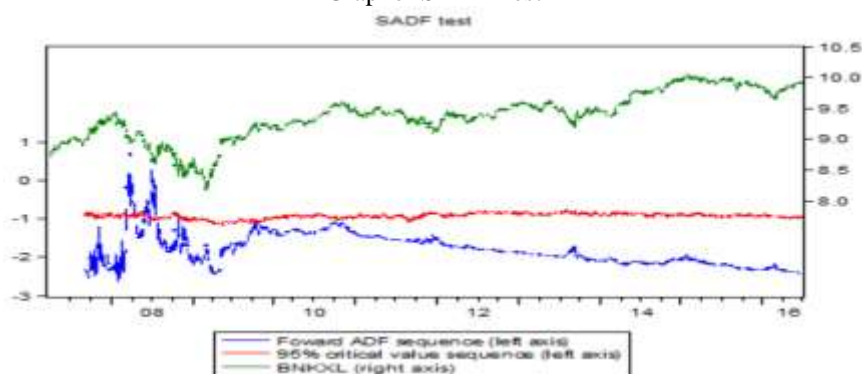
Right tailed ADF tests

Sample from 02/04/2007 to 30/06/2016

Included observation: 2293; Window sample=109

H0: BANKEX has a unit root, Lag length Fixed, L=0

Graph of SADF Test



IV. Conclusion

In the study the researcher has taken series of test from ADF to SADF. The journey of such test series is the journey of perfection and accuracy. In both test ADF and SADF the H0 is getting accepted as its P-value is greater than 5%. After testing BANKEX index on ADF, RADF, SADF it is clear and reasonable that the first two tests fails to reject H0 but the third test i.e. SADF have the probability and occurrence that are marginally near to the 5% and 95% benchmark, which gives the evidence of presence of assets pricing bubble in the S&P BSE BANKEX index. This outcomes detects that there may be traces of herding and cognitive behaviour on this sectorial index during period from 2007 to 2016. Thus it may be infer that Indian sectorial index named BANKEX has still may have some loop holes or deficient because of which behaviour like herding and cognitive error are impact the true valuation and leads to formation of asset price bubble. Other important factor in case of Indian stock market is that the proportion of retail investor as compared to FIIS and DIIs are very less because of which due entry of such big player into market frequently create jolt in this sectorial index and lead to formation of bubble. BANKEX, as a sectorial index fall into the category of complex market structures. In accordance to May-Winger who explains the theorem of stability, it states that complex market is unstable which leads to bubble formation.

If we observe first two tests ADF and Max RADF there probability is 62.5% and 34.5% respectively which is more than the benchmark probability of 5% which means we fail to reject null hypothesis. There occurrence level was also low as compared to the benchmark occurrence level. Therefore there impact is very less. But when we take third test SADF, the story entirely changes as both probability and occurrence are very near to benchmark level, so there may be possibility of presence of bubble in this sectorial index. This confirms, there is coupling of BANKEX from its known peers from the word of western region and ensures again that mechanism for predicting bubble due to unpredictable or uncertain volatility (i.e. unforeseen situation) as an offer.

Limitation of study and Scope for future work

There are various methods for spotting the presence of bubble in particular market; researcher had used one group of method for validation in Indian context on sectorial index. The time span for the study was nine years, in which first fifteen percent is of pre-crash period, then the middle part of data during the crash period contribute another fifteen percent while the remaining part constitute of recovery zone and contribute seventy percent of the total data. The assumption regarding ration may vary from study to study, researcher to researcher.. The dividend method using bubble detection was not taken into scope of study as there may be chance of the people to hold the surplus with them and then dividends are issued irregularly specially by the large companies who has high reputation.

Citation- books

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