

Identifying stock market bubbles and evaluation with momentum index and CCI

Sumera Aluru *

B. V. R. Vishnu Tej [†]

Mahathi Arkanath [§]

Dayananda Sagar College of Arts, Science and Commerce

Dayananda Sagar Institutions

Bangalore

Karnataka

India

Abstract

Stock markets ought to be efficient while stock prices reflect all available information fairly and equitably. This bubble majorly forms when market participants inflate stock prices above the stock value based on some valuation system. Identifying the formation of these bubbles becomes imperative to provide information for the investors and these bubbles need to be validated as well, hence this paper contemplates to identify the existence of stock market bubbles between 2017 and 2022 with respect to the BSE Sensex. It also aims to analyse, if the momentum index and consumer confidence index reflect the market bubbles along with performance when the bubbles crashed. The E-views platform for the data analysis and Dickey-fuller, Augmented Dickey-Fuller, Rolling ADF, and Supremum ADF tests were deployed for identification of bubbles. It is found that a major market bubble occurred between January-May 2020. Apart from identifying the bubble that occurred previously, this paper also intends to alert investors of future bubbles following the same pattern of indices. By analysing contributing factors leading to a bubble, investors can be better prepared for the next bubble and can adjust their strategies accordingly to minimize losses. Identification of stock market bubbles and validating them with momentum and consumer confidence indices just doesn't suffice the investor requirements. Further the factors leading to the formation of these bubbles, nature of these bubbles also attention. Bubbles happen for commodity prices, crypto-currencies and often might be of different types and might reflect entirely different

*E-mail: mallikasumera@gmail.com (Corresponding Author)

[†]E-mail: raghavishnutej@gmail.com

[§]E-mail: mahathia1202@gmail.com

behaviour, in that case how far can momentum and CC indices serve as leading indicators need to be explored as well.

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Introduction

Economic fluctuations are a natural phenomenon owing to the business cycles in the market. And often these cyclic movements of the economy translate into stock and is referred as a stock market bubble. This phenomenon is observed when market participants inflate stock prices above the stock value based on some valuation system. It is also widely referred as a speculative bubble. These bubbles are observed whenever the stock prices are inflated exorbitantly over a time period and often surpass the intrinsic value. Eventually, prices hit a wall and then plummet very quickly and far as the bubble bursts. Not only stock, but bubbles can also occur in various assets like commodities, crypto-currencies, and real estate.

A bubble is characterized by various stages of its formation viz., displacement, boom, euphoria, peak, and collapse. There can be several reasons for stock market bubble formation viz., cheap credit availability, political risks, wild speculation, random impactful economic event, investor fear lead panic, and of course market sentiment. It is also imperative to know about the possible consequences of stock market bubbles viz., Crash of Market, Recession, Widespread Discontent.

Real-time empirical identification of asset price bubbles, and even the retrospective identification of bubbles is certainly not an easy task, and it has been the subject of extensive debate within academic and professional circles for years. There is a natural setting for studying bubbles in the stock market in particular since stocks have a foundation that relies on the present value of future dividends. In the event of a bubble, there appear to be distortions in the policies, strategies, wealth, and psychology of society.

Even though there are studies, articles, and scholars using the word 'bubble' several times, investors are not aware of the signs and consequences of a stock market bubble. They do not control their sentiments towards the market and as a result, when the market crashes they suffer losses. Accordingly, the stock gets overvalued and touches its peak. Since overvaluation cannot stand for a long time, gradually the market crashes, and investors lose money without knowing the right exit point. The stock market bubble is an essential concept that every investor must be aware of.

Abundant studies and analyses must be done to identify the bubbles with ease. This can protect the investors.

The bubbles often are reckoned in hindsight, which means investors usually remain ignorant of the formation phases of the bubble. They only end up in regret after the bubble crashes resulting in un-precedent losses. Rarely, investors are aware of these bubbles and hardly have they had any idea about how to identify these aberrations in the market, so they encounter a situation of helplessness. In order to provide leading indicators that are effective in identifying the existence of bubbles, the present study was attempted. The major driving force behind the trading volumes in the market is momentum trading. Understanding the momentum can generate enough space to explore bubbles as well.

It is imperative for investors to be aware of their investing strategy falling in-line with momentum or against it. Investors must reckon that momentum is a leading indicator for a stock price. However, momentum chasing need not be always the single motivator for investors, as many a times it can lead to sub-optimal decisions. An investor uses momentum trading or momentum investing to take advantage of price oscillations in asset prices to maximize profits. In momentum trading, assets whose prices are rising are analyzed in the short term and bought. Later, profits can then be made by selling those assets when the prices seem to have peaked. The Consumer Confidence Index measures consumer attitudes and confidence about financial prospects. It is based on Consumer Confidence Survey. According to the CCI, consumers spend more when optimistic, stimulating the economy, and spend less when pessimistic.

Review of Literature

“Rakhmat, A. S., & Fahamsyah, M. H. (2023) illustrated that Stock market bubbles are times when valuation dynamics are momentarily explosive. Stock bubbles can be interpreted as a deviation of stock prices from their fundamental value. LPPLS is one model to calculate a bubble if an asset's observed price trend differs from its intrinsic fundamental value during a bubble era. This research is a qualitative study or descriptive research to review the LPPLS as a model to calculate bubbles in stock.”

“Guerron-Quintana, Pablo A et. al., (2023) analyzed the ups and downs in economic growth in recent decades by constructing a model with recurrent bubbles, crashes, and endogenous growth. Once realized, bubbles crowd in investment and stimulate economic growth, but expectation about future bubbles crowd out investment and reduces economic growth.”

"Omiete Victoria Olulu-Briggs, and Daniel Dornubari Sunday (2023) used the Supremum Augmented Dickey-Fuller (SADF) and Generalized Supremum Augmented Dickey-Fuller (GSADF) quantitative model along with the Backward SADF estimation detected three periods of explosive pricing and collapses."

"He, Chaolin & Gao et. al., (2023) provide a bubble date-stamping mechanism using the agent-based computational finance method. The key steps of the bubble date-stamping mechanism are the construction of the simulated financial market, the computation of the characteristic indexes, and the thresholds of the Price Band in the simulated financial market."

"Zhang, Xiaoming. et. al., (2023) creatively analyze the determinants of systemic risk for Chinese financial institutions from the view of asset price bubbles. They identify bubbles in the China stock and real estate markets based on the generalized sup Augmented Dickey-Fuller (GSADF) model and explain the reasons for bubble formations according to the stage of China's economic development and policy implementation."

"Kang, J. (2023) aims to summarize Shiller's point of view regarding the Feedback Model and how humans react to the price bubble. The paper introduced the formation process and measurement method of foam of bubbles in detail." "Han, Bing & Hsu, Jason (2022) conducted an expansive literature check on stock instigation."

"Martin B. Tarlie et. al., (2018) defined stock market bubbles and anti-bubbles as periods in which the dynamics of valuation are temporarily explosive, using a simple model of equity valuation."

"Kumar, S. and Goyal, N. (2015) conducted a study to systematically review the literature published in the past 33 years on behavioral biases in investment decision-making. Farmer, R. E. A. (2015) attempted to study the connection between the stock market and the unemployment rate."

"Bolton, P., Chen, H., & Wang, N. (2013) show quantitatively that the real effects of financing shocks may be substantially smoothed out as a result of firms' adjustments in anticipation of future financial crises."

"Jia Wang et. al., (2009) emphasize that a stock market crash affects individual stocks and if stocks with different financial characteristics are affected differently in a stock market crash is an issue that has not received sufficient attention."

"Stasys Girdzijauskas & Dalia Streimikiene (2008) conducted a study that deals with stock market bubbles and analyses the origin of their formation."

"Kaliva, K., & Koskinen, L. (2008) propose an autoregressive regime-switching model of stock price dynamics in which the process creates pricing bubbles in one regime while error correction prevails in the other."

“Thomas Lux (1995) attempted to formalize herd behavior or mutual mimetic contagion in speculative markets. Randall Morck et. al., (1990) convey through their study that the stock market is not driven solely by news about fundamentals. Barro, R. J. (1990) emphasized that especially for long-term samples and particularly in the presence of cash flow variables, changes in stock prices have significant explanatory power for U.S. investment.”

Methodology

This study is descriptive in nature. The data required for this study was collected from BSE INDIA website. The BSE Sensex 30 (BSESN) daily closing prices for the past 6 years (2017-2022) are considered for the analysis. The Consumer Confidence Index data was collected from the OECD website. To identify the existence of bubbles in the index returns, log-returns of the index values was generated. Subsequently, the three right-tailed ADF tests were run to empirically identify the existence of a unit-root. The data is tested with ADF (Augmented Dickey-Fuller), RADF (Rolling Augmented Dickey-Fuller), and SADP (Supremum augmented Dickey-Fuller).

By using these tests, researchers can determine whether a stock market bubble exists or not by analysing the time series data for the stock prices. If the data is non-stationary, it could be an indication of a bubble, while if it is stationary, there is likely no bubble. These tests are widely used by researchers to analyse stock market bubbles and can be a useful tool in understanding the dynamics of financial markets.

Firstly, the Dickey-Fuller Test (DFT) was run on the data. After empirically proving that no unit root exists for the dataset, the Augmented Dickey-Fuller test was conducted. Further, to verify the existence of a bubble, Rolling ADF and Supremum ADF test was conducted. An evident bubble was detected in Jan 2020-May 2020. To further support this finding and also generate leading indicators for investors, Momentum Index and Consumer Confidence Index data for the same period were considered.

Analysis and Interpretation

As a pre-requisite, it is essential to validate whether the data set has a unit root. If the data set has a unit root then it is a validation that the data is uniform without any aberrations in it. So, if the test results of the Dickey-Fuller Test (DFT); three cases: No Drift, Drift, and Drift+ Trend

were conducted and the results reveal that the data set has no unit root (Table 1), then only it can be further analysed for existence of bubbles. This first test was run to check whether there exists a unit root in the data..

Table 1
(T-stat compared to -3.96)

Dicky fuller's critical values	No Trend	Trend
1%	-3.43	-3.96
5%	-2.86	-3.41

From the above results obtained, it can be inferred that there is no unit root in the data considering all three cases.

To further ensure that the dataset doesn't have unit root, an advanced test referred as RTADF was run (Table 2). The right-tailed version of the standard ADF unit root test. The right tail of the statistic's non-standard distribution is required, the critical values for testing the null hypothesis differ from those utilized in the usual ADF unit root test.

Table 2

AUGMENTED DICKEY-FULLER TEST
H0: Series is having unit root or is non-stationary
H1: Series is having mildly explosive exponent or trend stationary.

The test is conducted with three cases: Lag=0, Lag=1, and Lag=2.

Table 3(a)
ADF TEST WITH LAG=0

Right Tailed ADF Tests Sample : 1/02/2017 1/05/2023 Included observations: 1490 Null hypothesis: PRICE has a unit root Lag Length: Fixed, lag=0 Window size: 84 Date: 01/22/23 Time: 08:14		
	t-Statistic	Prob.*
ADF	-2.093500	0.4430
Test critical values**:		
99% level	-0.267545	
95% level	-0.888218	
90% level	-1.250380	
*Right-tailed test **Critical values are based on a Monte Carlo simulation (run with EViews)		

Table 3(b)
ADF TEST WITH LAG=1

Right Tailed ADF Tests Sample : 1/02/2017 1/05/2023 Included observations: 1490 Null hypothesis: PRICE has a unit root Lag Length: Fixed, lag=1 Window size: 84 Date: 01/22/23 Time: 08:46		
	t-Statistic	Prob.*
ADF	-2.096592	0.4430
Test critical values**:		
99% level	-0.267545	
95% level	-0.888218	
90% level	-1.250380	
*Right-tailed test **Critical values are based on a Monte Carlo simulation (run with EVIEWS)		

Table 3(c)
ADF TEST WITH LAG=2

Right Tailed ADF Tests Sample : 1/02/2017 1/05/2023 Included observations: 1490 Null hypothesis: PRICE has a unit root Lag Length: Fixed, lag=2 Window size: 84 Date: 01/22/23 Time: 09:18		
	t-Statistic	Prob.*
ADF	-2.096633	0.4430
Test critical values**:		
99% level	-0.267545	
95% level	-0.888218	
90% level	-1.250380	
*Right-tailed test **Critical values are based on a Monte Carlo simulation (run with EVIEWS)		

All the tests were run on the E-views platform using the add-in RTADF (Right tailed Augmented Dickey-Fuller). Right tailed ADF tests with three different lags as shown in the Table No. 3(a), 2(b) & 2(c), it can be observed that the same probability of 44.3% is generated in all three lag cases. There exists a lag difference through the difference in t-statistic values, however, the probability remains the same. Owing to the lower t-statistic values the null hypothesis cannot be accepted. It is empirically evident from the ADF test that the series does not have a unit root.

ADF test only ensures that the data set doesn't have a unit root, hence is not a full-proof test for identifying bubbles. RADF (Rolling Augmented Dickey-Fuller test) was found to be more suitable test for identifying the existence of bubbles or abnormal deviation in the dataset as is conducted by Zhang, Xiaoming. et. al., (2023) and Omiete Victoria Olulu-Briggs, and Daniel Dornubari Sunday (2023) in their study.

It can be inferred from the RADF test that there exists a major market bubble between January 2020 and May 2020 as can be observed in the Figure no.1(a).

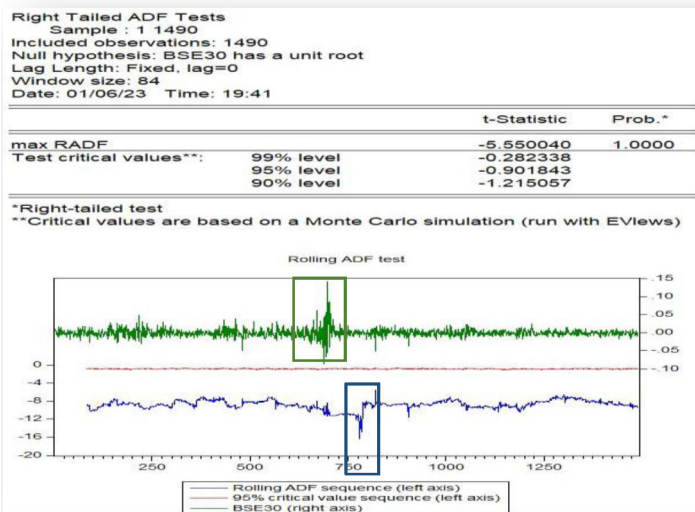


Figure 1 (a)
RADFT Results

To further verify and validate the RADF results, SADP (Supremum Augmented Dickey-Fuller) test is conducted (Figure 1(a)). The SADP test shows distinctly the existence of the bubble. These tests also provide empirical evidence that the dataset has not unit root but also show the existence of a bubble as can be inferred from the Figure no.1(b).

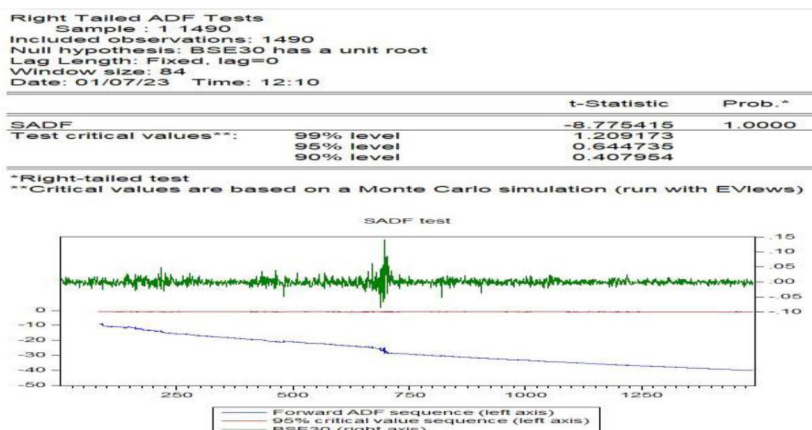


Figure 1 (b)
RADF Results

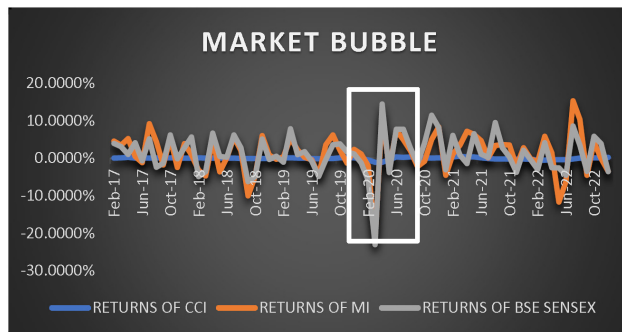


Figure 1 (c)

BSE Sensex Returns, Momentum Index and CCI Values from 2017-2022

BSE Sensex returns values are plotted on a graph can revealing the bubble formation during January 2020-May 2020 (Figure 1(c)).

To further support the analysis conducted earlier and further generate leading indicators for the formation of bubbles, S&P Momentum Index data for the period 2017-2022 is considered and studied. When the momentum index values are plotted on a graph, it reflects a fall in the index values during the same period during which the bubble was formed. This graphically validates that the bubble formation is reflected in the drop in the momentum index. In order to explore whether there was any reflection of the bubble formation on the Consumer Confidence Index, these values were extracted from the reliable source –OECD website for the study period. These values when plotted on graph revealed that the consumer confidence dipped during the same period when the bubble formation was observed. It can be vividly observed that there was high momentum and peaking consumer confidence as the bubble inflated and when the bubble burst happened, it was reflected perfectly with the sudden drop in the momentum index and similar fall in the consumer confidence index.

Conclusion

The test results of various tests run, empirically validate that there exists a stock bubble between January 2020 and May 2020. It is supported by the different tests conducted through the E-views platform. The BSE Sensex returns, Consumer Confidence Index, and Momentum Index provide prominent evidence to prove the existence of the bubble and also that momentum index and CCI can serve as indicators for bubbles. While analysing, the probable reasons for the bubble, the then prevailing

pandemic situation might be one of the reasons that shook the market. The findings also indicate that investors should remain vigilant for future bubbles observing the momentum index and CCI index. Whenever these indices are inflating abnormally, it can be a signal bubble formation and thus remain cautious.

Predictive Analytics can be used to forecast the bubble occurrence in the future. There is further scope to extend the study by conducting the GSADF (Generalized Supremum Augmented Dickey-Fuller) to evidently detect if bubbles have occurred. Further Google Text Analytics can be used as a major tool to understand investor psychology and their emotions based on google searches during the bubble occurrence period so that further bubble forecasting can be done easily and accurately.

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