Early Warning Indicators for Financial Crisis during Covid-19

Aakash Jignesh Modi[1]**, Jyothish Lal G**[1]**, Gopalakrishnan EA**[1]**, Sowmya V**[1]**, Soman KP**[1]**, and Vinayakumar R**[2]

[1] Center for Computational Engineering and Networking (CEN), Amrita School of Engineering, Coimbatore, Amrita Vishwa Vidyapeetham, India

[2] Center for Artificial Intelligence, Prince Mohammad Bin Fahd University, Khobar, Saudi Arabia

Introduction

Why do we need to study the financial market in context of covid–19 pandemic?

- *Unpredictability*
- *Complex dynamics.*

Stock market dynamics are subject to sudden changes due to external events, which can be

- *Local events* [1,2,3,4]
- *Global events* [5,6,7].

The covid–19 is a unique event in terms of its global scope as a pandemic & its impact on the financial market.

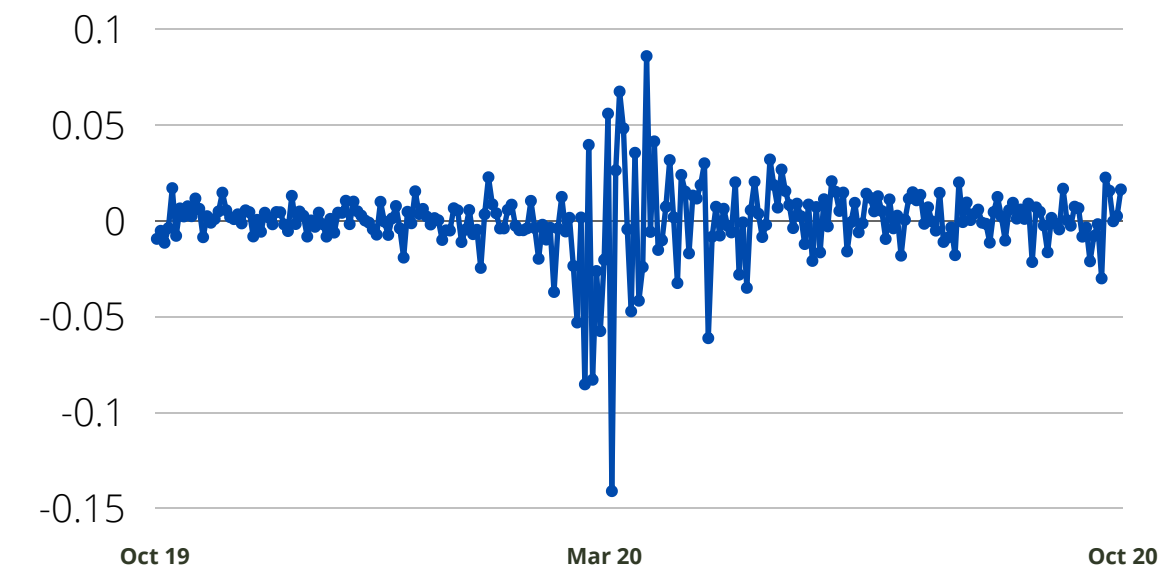**Why do we need to study the financial market collapse?**

'Black Swan Event'

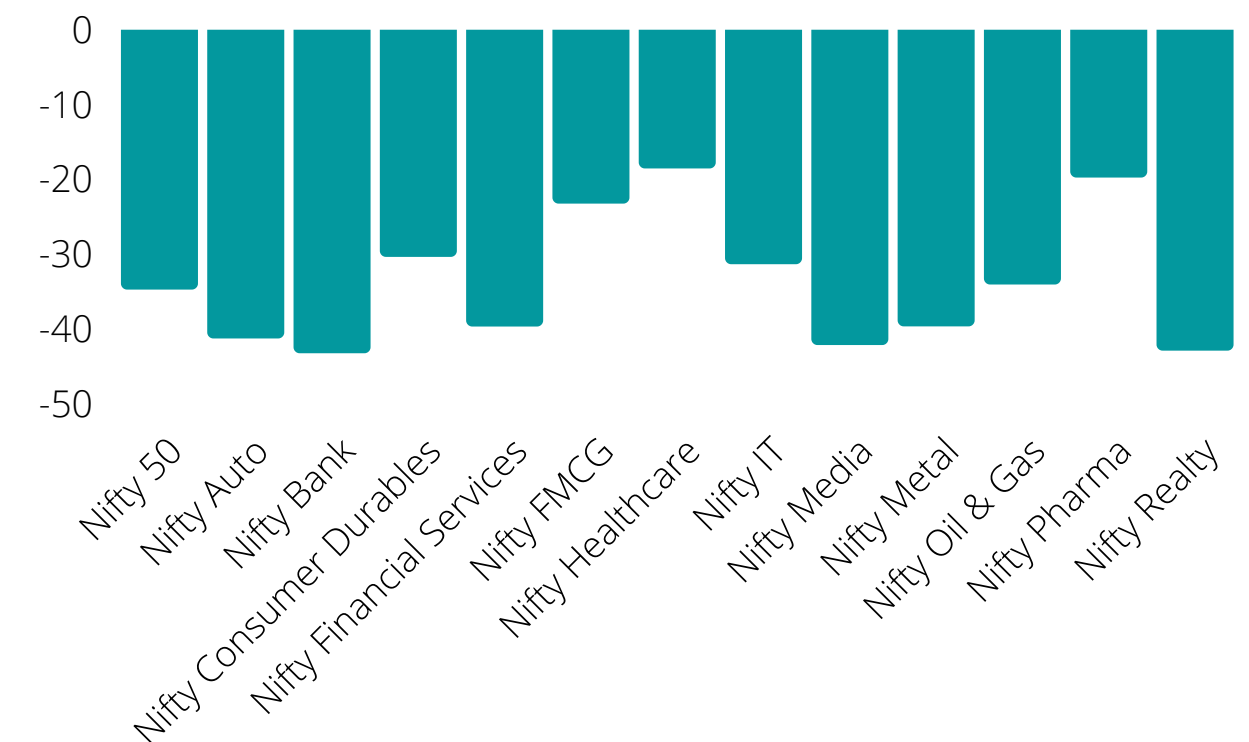The occurrence of a highly unpredictable event with far-reaching consequences.

Investor's money lost:
Rs 56.22 trillion^

^https://www.business-standard.com/podcast/markets/market-wrap-march-23-here-s-all-that-happened-in-the-markets-today-120032301143_1.html

BSE stock index return plot

Percentage change in the closing price for different Nifty indices between 30 January 2020 (first confirmed case of covid-19 in India) and 23 March 2020 (lowest point to which Nifty plummeted).
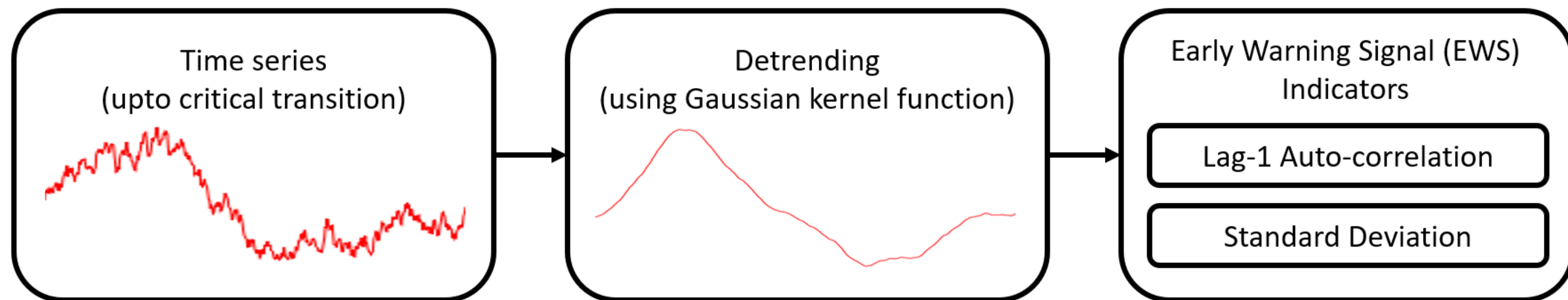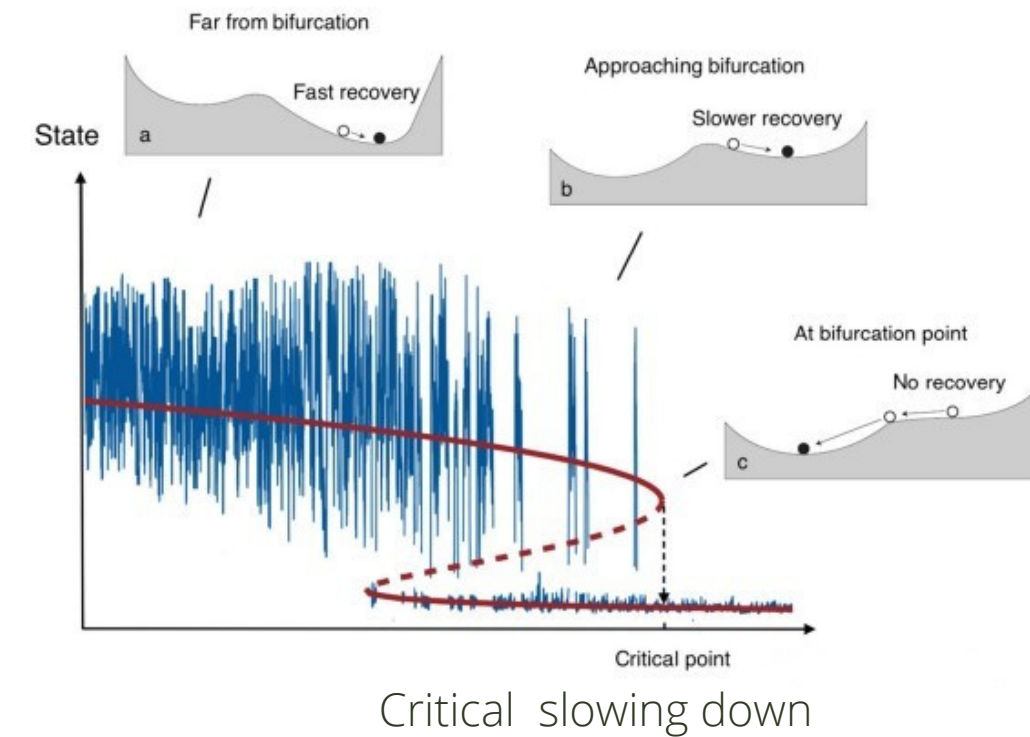
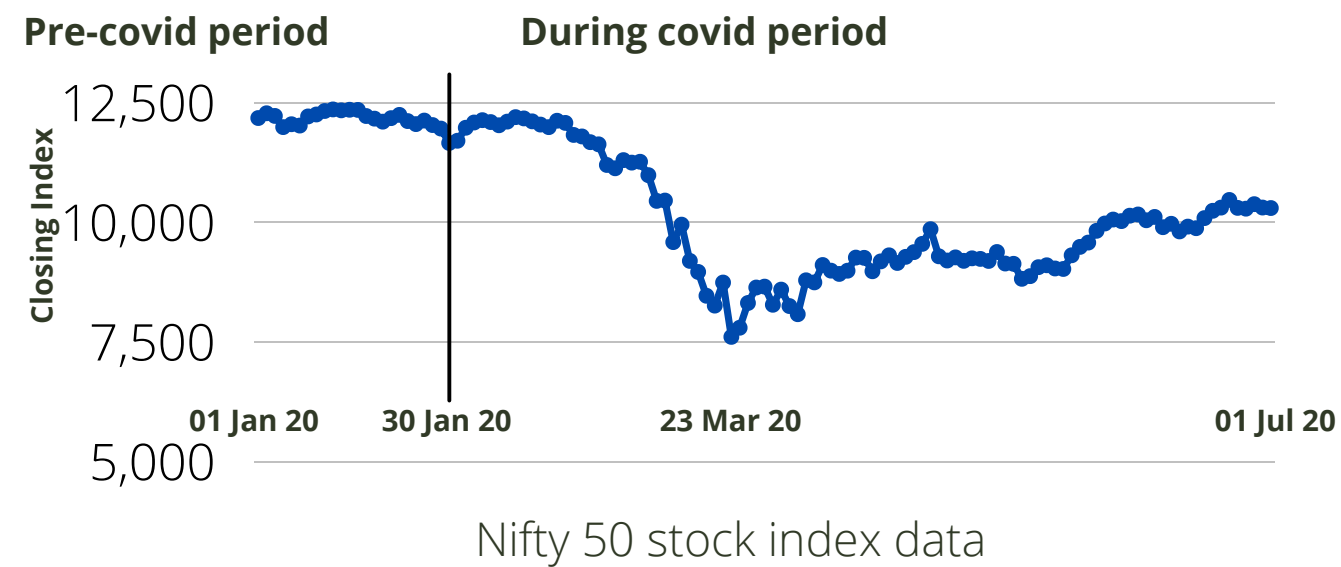Aakash Jignesh Modi *et al.*

Open questions

- Are pandemics systematically important to financial markets?

- Is it possible to know early about the stock market transition from bearish to bullish mode or vice versa?

Objectives

- Impact of Covid-19 pandemic on the Indian stock market.

- Investigate different early warning measures to predict stock market collapse due to the Covid-19 pandemic.

Methodology

Pre-covid period   **During covid period**

Nifty 50 stock index data

Critical slowing down

Time series
(upto critical transition)

Detrending
(using Gaussian kernel function)

Early Warning Signal (EWS)
Indicators

Lag-1 Auto-correlation

Standard Deviation

^ https://www1.nseindia.com/
^^ http://www.early-warning-signals.org/
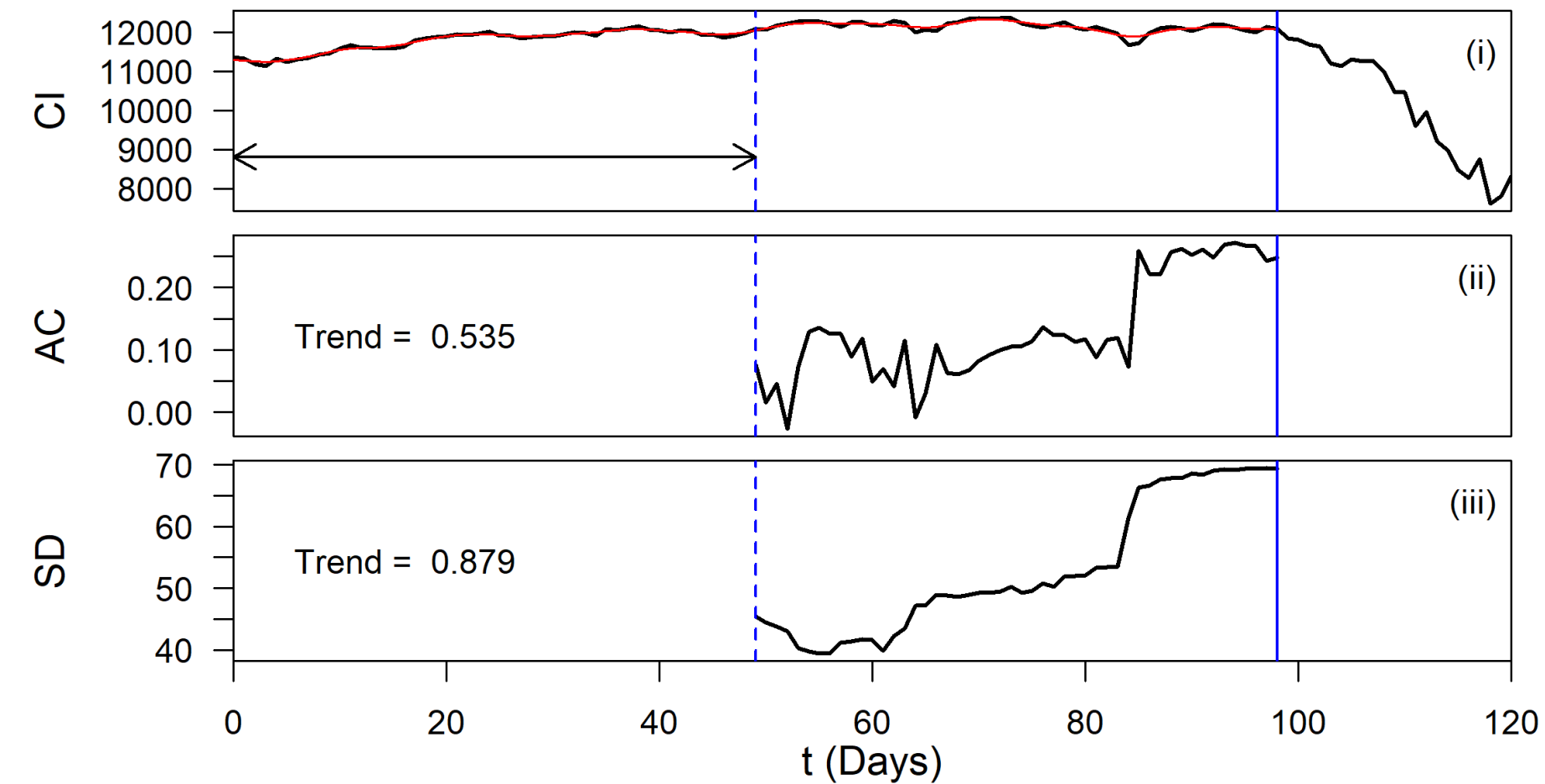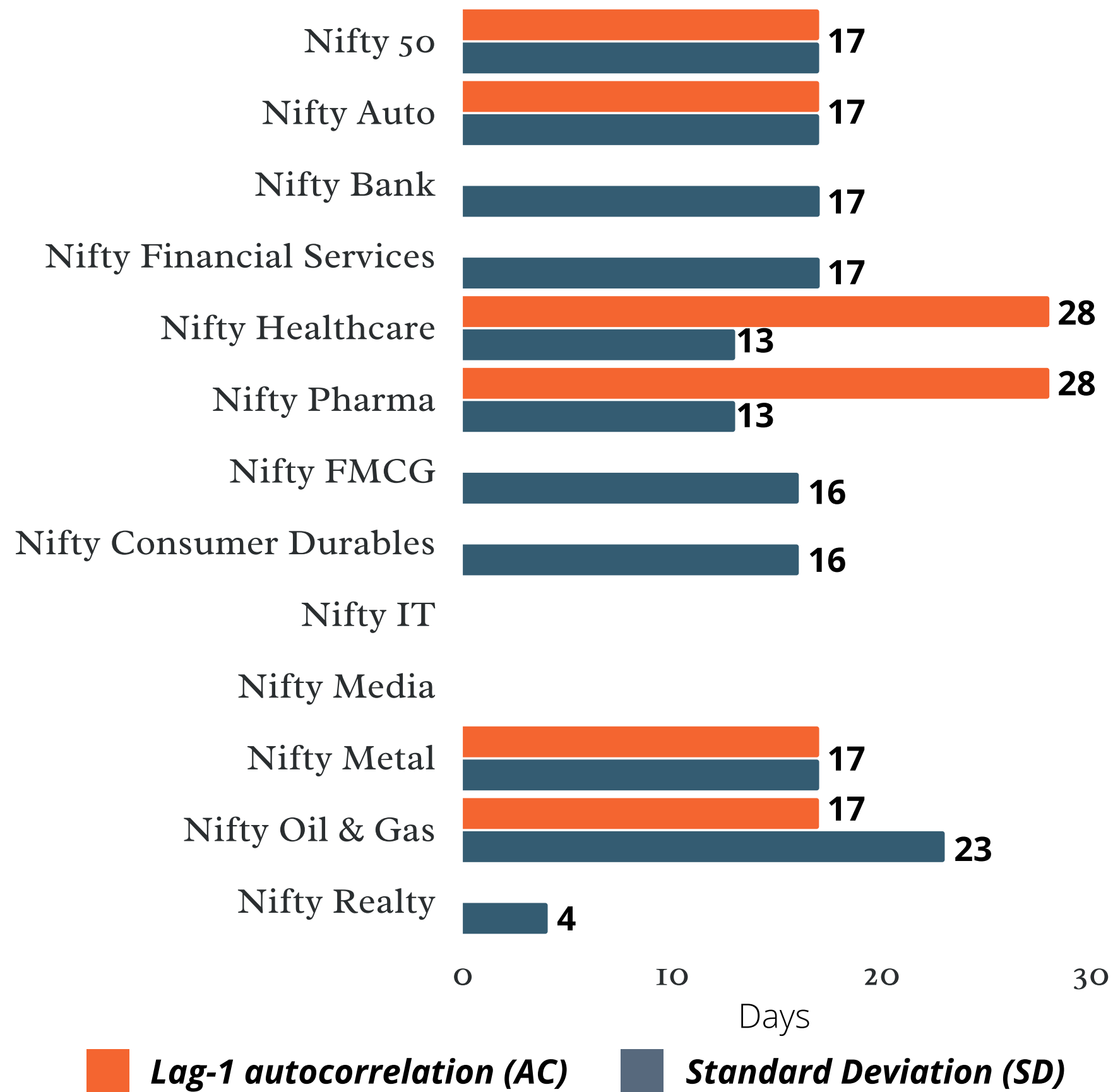
Results & Discussion

Stock market collapse prediction based on Trend value or Kendall-τ using Return Rate (RR), Lag-1 Auto-correlation (AC) & Standard Deviation (SD)

Stock Index	RR	AC	SD
Nifty 50	-0.435	0.535	0.879
Nifty Auto	-0.536	0.522	0.213
Nifty Bank	-0.195	0.693	0.685
Nifty Financial Services	-0.44	0.708	0.847
Nifty Healthcare	-0.343	0.314	0.441
Nifty Pharma	-0.29	0.279	0.182
Nifty FMCG	-0.218	0.189	0.445
Nifty Consumer Durables	-0.33	0.298	-0.027
Nifty IT	-0.29	0.29	-0.538
Nifty Media	-0.404	-0.304	-0.848
Nifty Metal	-0.463	0.677	0.363
Nifty Oil & Gas	-0.167	0.126	0.775
Nifty Realty	0.001	-0.289	0.598

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(i) **Closing index (CI) time series depicting stock market crash or transition for Nifty 50 index. Plot depicting the change in (ii) lag-1 autocorrelation & (iii) standard deviation.**

Conclusion

- Lag-1 auto-correlation and standard deviation early warning measures with window length 0.5T were able to sight the upcoming transition or market crash much prior to the system critical point, which is in accordance with the slowing down theory.

- Compared to lag-1 auto-correlation, **standard deviation plots showed better regime shift points**.

- The **potential transition was clearly noted for all the indices** with the early warning measures **except for the Nifty Media index**.

- The study can further be extended to check the robustness of the proposed methodology with other early warning indicators like model-based indicators as proposed by Dakos et al **[9]**.

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