Slide 1:
Hello, we are team 2 and today we are going to discuss an article of great relevance in the world of finance: "A Prediction Approach for Stock Market Volatility Based on Time Series Data." by Sheikh and the others.

Introduction:
Let's start with a brief introduction. In the ever-changing landscape of finance, predicting stock market volatility is crucial for investors, traders, and businesses. This research focuses on using time series data and a specialised model to forecast market volatility accurately.

Slide 2 (Forecasting pathway):
We will begin with a description of the forecasting process, this will serve as an outline of the research paper at hand.
So to make a forecast, initially the problem is identified, during this stage it is also important to analyse how these forecasts will be used and who will benefit from the forecasts.
Following on, data is gathered and in the article, the focus is on the two main indices of the indian economy the sensex and the nifty indexes.
In the next step the collected data is analysed to identify the important features and remove the redundant information.
Then different models are compared and the model with the best performance is chosen for forecasting.
Lastly, the model is put into practice with periodic tuning and model evaluation.

Slide 3: (Problem statement)
The first question we address is: What's the problem?
Accurate forecasting in the stock market is challenging but essential for decision-making. The aim is to provide a solution to this challenge through our predictive approach based on time-series data of the Indian stock market.

Slide 4:(Actuality)
In today's world, forecasting plays a pivotal role in diverse fields worldwide. Financial forecasting, in particular, acts as a compass, guiding businesses through future uncertainties. India, with its thriving economy, has emerged as a magnet for global investors. Moreover, there's a growing focus on exploring the potential of time series data, opening doors to new insights and opportunities. Together, these factors underscore the significance of our discussion today.

Slide 5: (Forecasting Models)
AR (*AutoRegressive*): AR models predict future values by considering a linear combination of past values of the variable being forecasted. It relies on the idea that the current state depends on its past states.
MA (*Moving Average*): MA models are based on error terms and predict future values by considering a linear combination of past error terms. It emphasises the impact of previous errors on future outcomes.
ARMA (*AutoRegressive Moving Average*): ARMA models combine both AR and MA components. They incorporate past values of the variable and past error terms to make predictions, offering a comprehensive approach to time series forecasting.
ARIMA (*AutoRegressive Integrated Moving Average*): ARIMA model is diversified and suitable for handling non-stationary time-series data. They include three components: AutoRegressive (AR), differencing (to make data stationary), and Moving Average (MA), making them effective in capturing complex time series patterns.

Slide 5 & 6

Slide 7:
Okay, so now we will cover the methodology that the authors of the article implemented. Firstly, they tested the data for stationarity using the augmented dickey fuller test. Thereafter they plotted the ACF and PCF curves which help us to find optimal parameters for the MA and AR terms and to determine whether our series is stationary.
Then we decompose the time series into 4 separate components (the Original, Trend, Seasonality and residual(shows the noise) components).
In step 4 we select the best ARIMA(p - the order of the AR component (autoregressive),d - degree of differencing, q-order of the MA component) model using the auto.arima function and the Aikaike Infromation Criterion minimization.
Lastly, we perform the L-Jung-Box test to check whether our residuals are uncorrelated which is important for the overall effectiveness of the forecasting model.

Slide 11:
As an extension of the research paper at hand our team has decided to implement the LSTM model for forecasting 2016 Nifty and Sensex market performance. We decided to focus on an LSTM because it is an RNN model which captures long-term dependencies and complex patterns in data.

LSTM's 'memory' and 'forget gate' mechanisms enable it to retain crucial information while discarding irrelevant noise. This makes it particularly suited for modelling financial time series data, where hidden patterns and complex relationships often exist.

Input Gate: The input gate determines which information from the current time step should be stored in the cell state. It uses a sigmoid activation function to regulate the values between 0 (discard) and 1 (retain).
Forget Gate: The forget gate decides what information from the previous cell state should be forgotten or retained. Like the input gate, it utilises a sigmoid activation function to control this process.
Output Gate: The output gate produces the final prediction based on the cell state and input from the current time step. It combines the information stored in the cell state and applies another sigmoid activation function to produce the output.

Slide 12:
Okay, so now I am going to cover some of the implementation points in our LSTM model.

Firstly, we split our 2012 - 2016 dataset into vectors consisting of 247 consequent data points.

Second, we trained our neural network on these vectors to predict a vector of 247 points which acts as a forecast for the year ahead.

Third, we generated the glorious graphs which you may observe on the slide above.
To create these graphs we have used a bootstrap technique to generate 50 different models and calculated the mean prediction and the standard deviation of these models to graph the red line and the confidence intervals.

Slide 13:
Here is a slide that shows that similar results were achieved for the SENSEX dataset.

Now to summarise our results and reach a conclusion regarding the performance of the ARIMA model and the LSTM model we have compared the MAE and RMSE metrics.

THe results are summarised in the table. You may observe that the ARIMA model performed better than the LSTM by both metrics. Therefore, we conclude that the ARIMA model is more suitable for making forecasts regarding the performance of the Indian financial market.

Okay so this is the end of our presentation. Do you have any questions?