

# **Bitcoin Realized Volatility Forecasting with GARCH & Multivariate LSTM**

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# Overview

## Bitcoin

- Decentralized Cryptocurrency
- First Appearance in 2009
- Recognized
- Bitcoin Options & Futures

→ Realized Volatility Forecasting

# Business Problem

risk management

market making

portfolio optimization

option trading

# DATASET

- 2500 datapoints
- Yahoo Finance
- 09/2014 – 08/2021
- Open/High/Close/Low



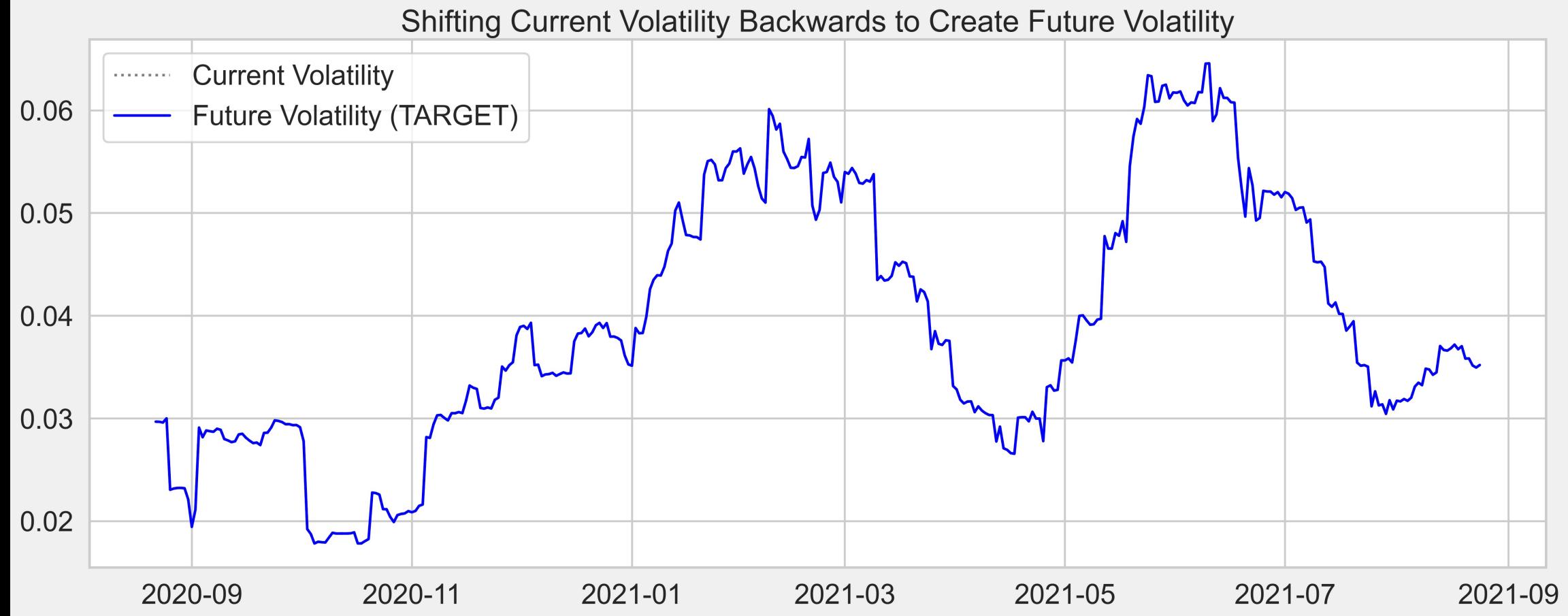
# Volatility Measuring

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$$\sigma_{daily} = \sqrt{\sum r_{t-1,t}^2} * \sqrt{\frac{1}{interval - 1}}$$

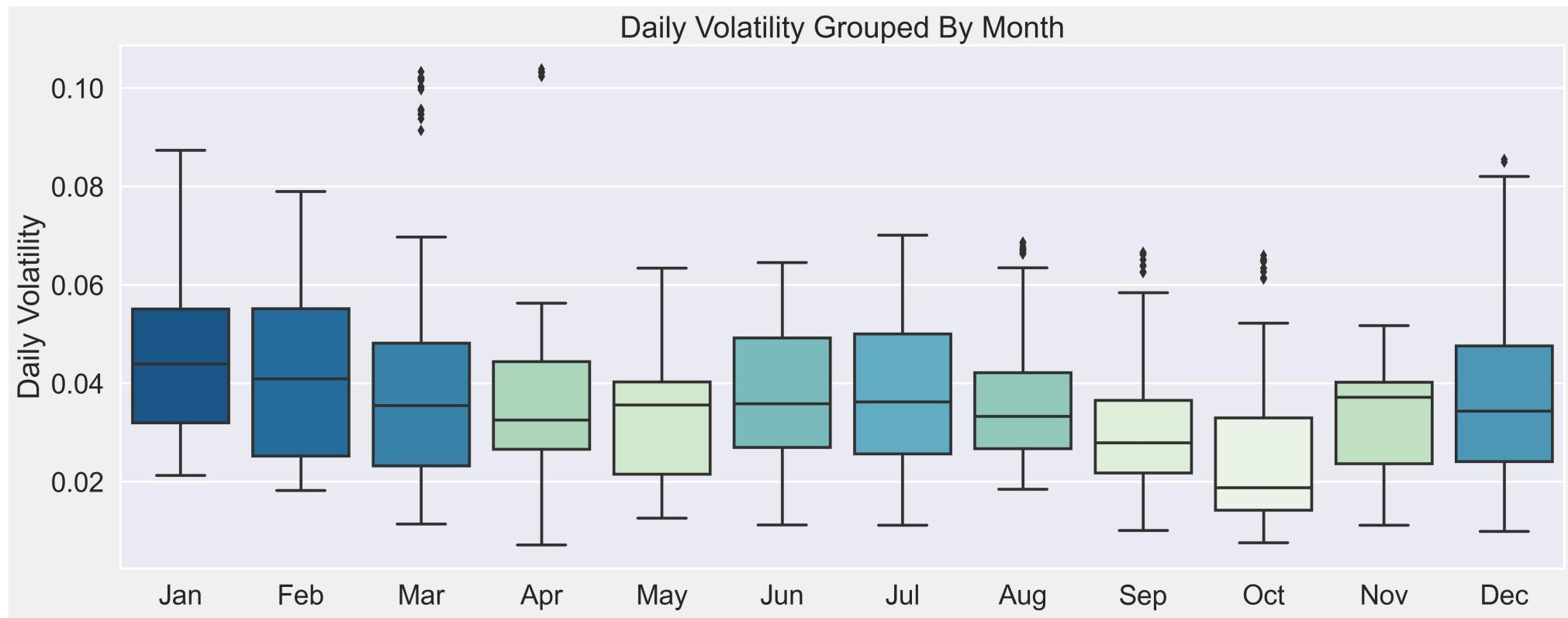
- Log Returns
- Forecast horizon = 7 days
- Window Interval = 30 days

### Shifting Current Volatility Backwards to Create Future Volatility



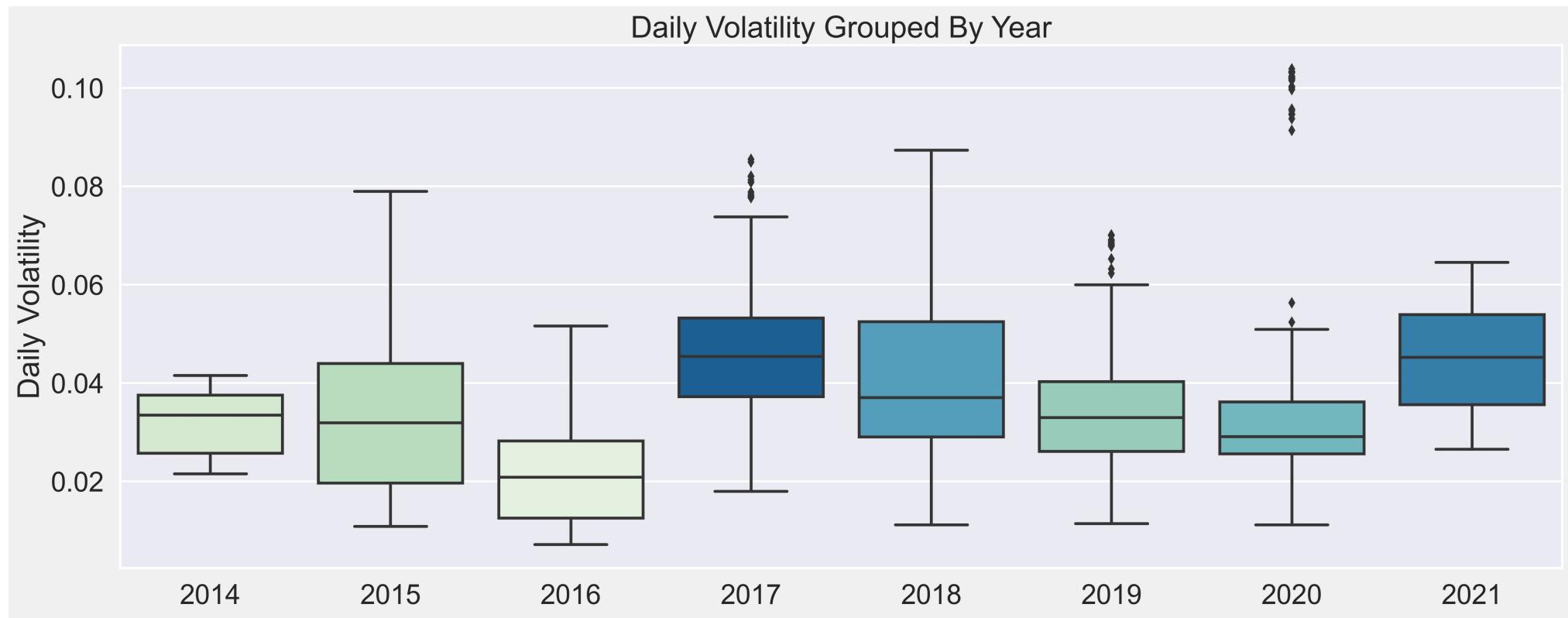
# Volatility Grouped by Month

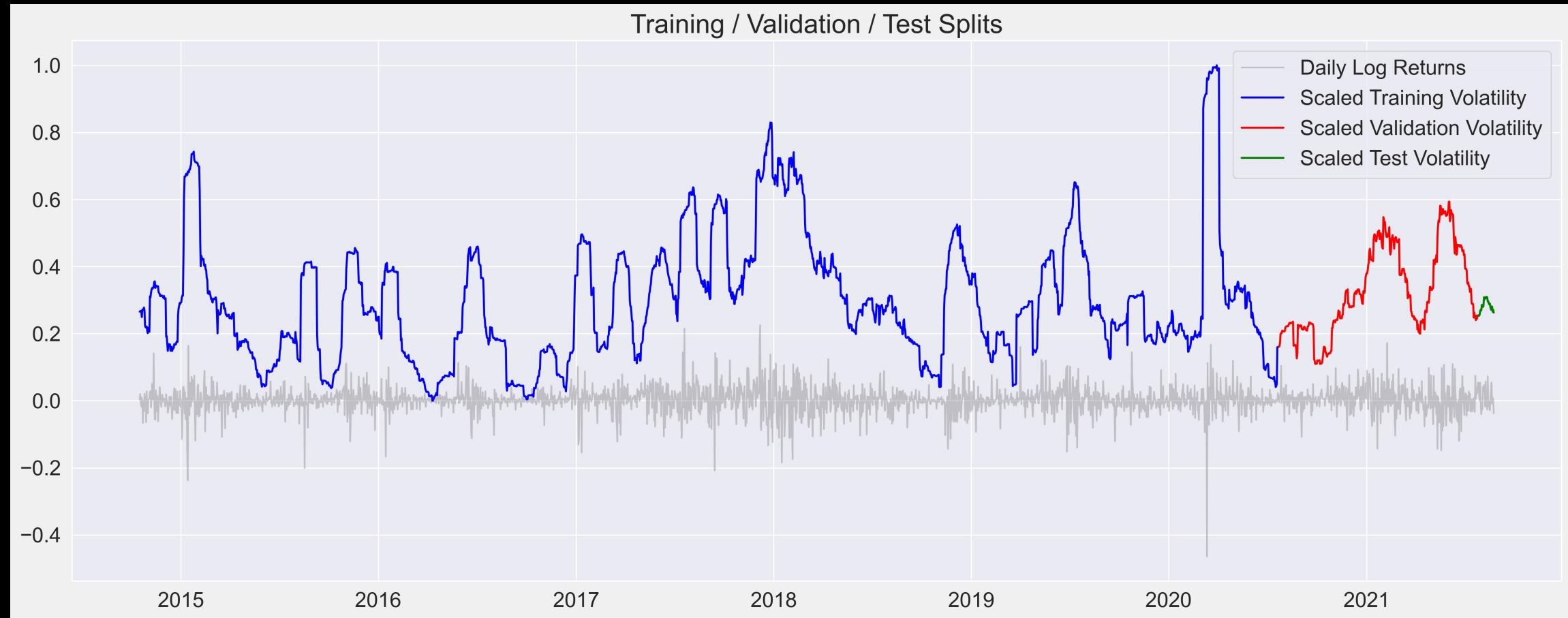
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# Volatility Grouped by Year

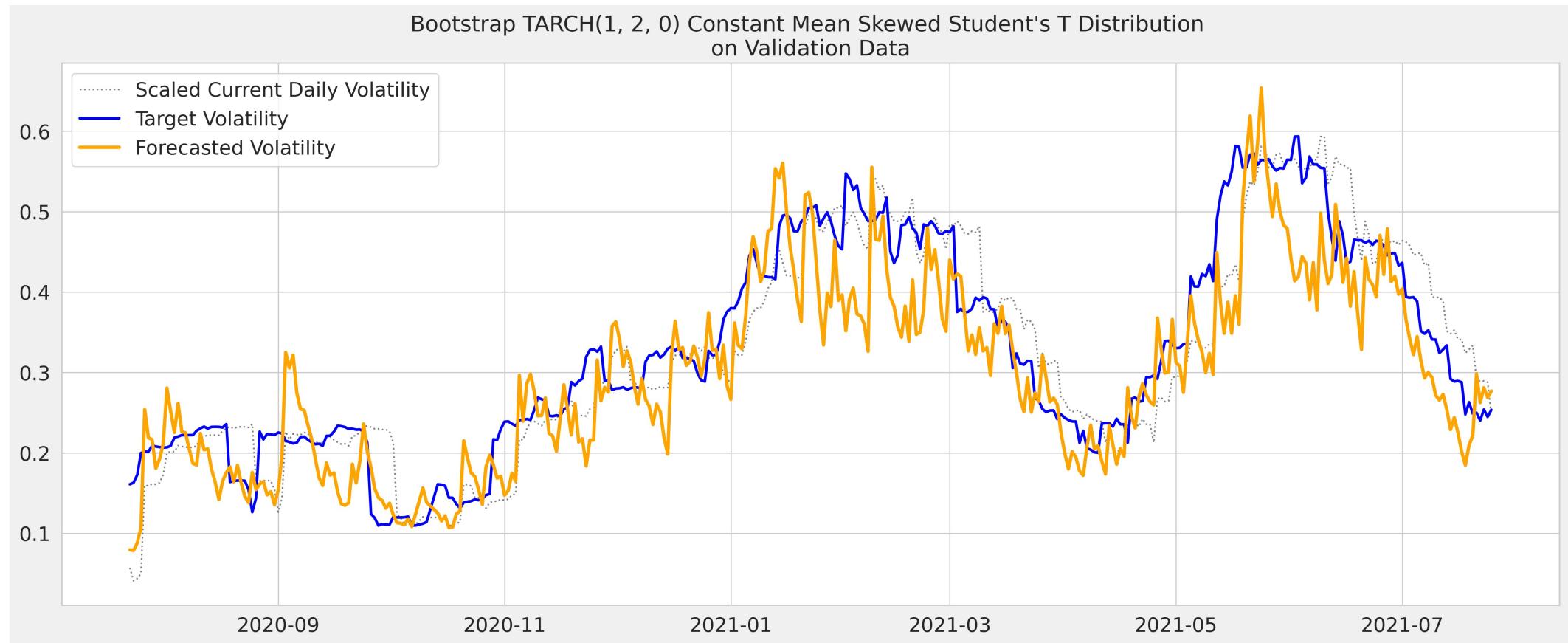
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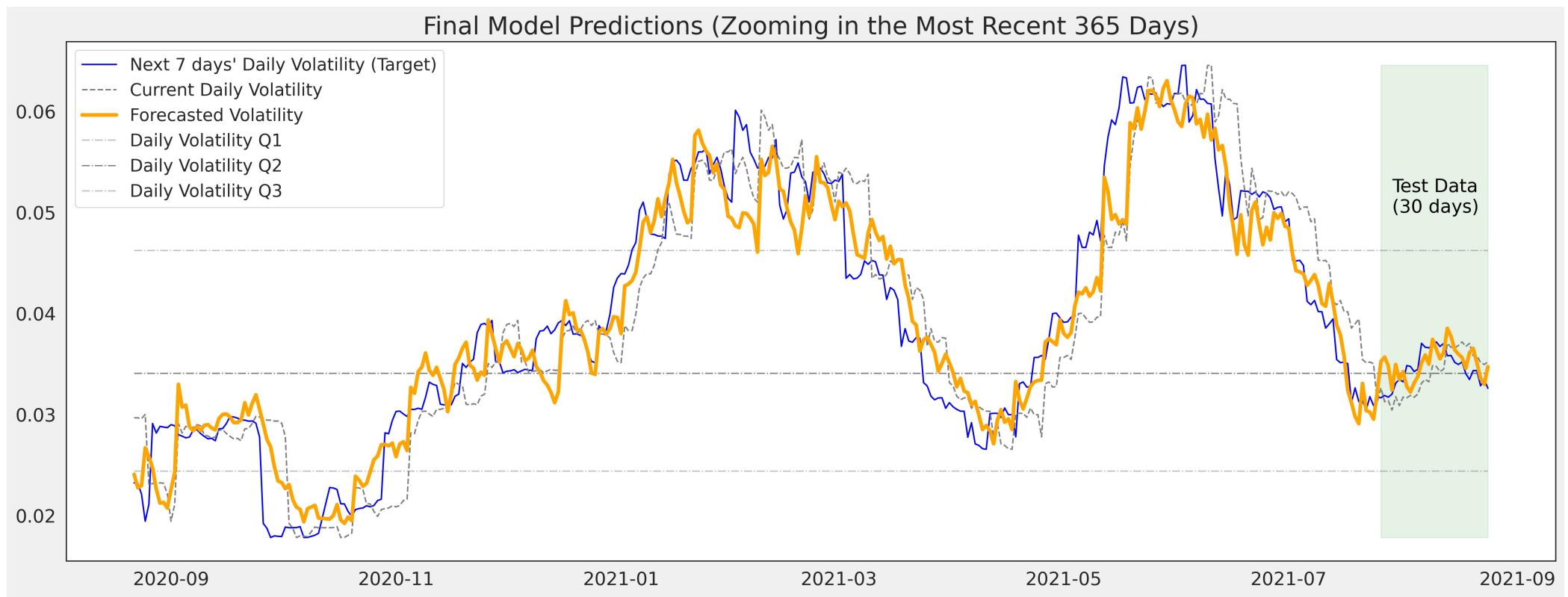


# GARCH

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# Multivariate LSTM



# Conclusions

## Multivariate LSTM

- More accurate on Validation set
- 94.65% on Test set
- alpha decay
- frequent tuning and maintenance

# Next Steps

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- WaveNet
- Economic Calendar Events
- Different Frequencies/Intervals

Thank you!

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