

## UBL - ML-Based Financial KPI Forecast (2019 Backtest)

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History used for model training: 2014-12-31 to 2018-12-31.

Validation (backtest) period: 2019-09-30 to 2019-12-31.

Macroeconomic drivers used (exogenous inputs):

- CPI Inflation (%)
- GDP Growth (%)
- Policy Interest Rate (%)
- USD/PKR Exchange Rate

Models used per KPI:

- Naive random-walk benchmark
- SARIMAX (ARIMA with quarterly seasonality) with macro drivers
- Ridge regression on KPI lag features

Best model is selected by lowest MAPE on 2019 backtest (except Borrowings, where last-quarter error is prioritised).

Key messages (based on last available 2019 quarter per KPI):

- Deposits: last 2019 point 2019-12-31 – actual 1,557,995,306, model 1,690,279,955 (abs error 8.5%, best model: Ridge\_Lag).
- Advances: last 2019 point 2019-12-31 – actual 694,548,909, model 754,551,722 (abs error 8.6%, best model: Naive).
- Investments: last 2019 point 2019-12-31 – actual 874,435,902, model 831,159,100 (abs error 4.9%, best model: Naive).
- Borrowings: last 2019 point 2019-12-31 – actual 170,405,060, model 172,531,156 (abs error 1.2%, best model: Ridge\_Lag).
- Total\_Assets: last 2019 point 2019-12-31 – actual 2,022,818,979, model 2,002,492,874 (abs error 1.0%, best model: Naive).
- Total\_Equity: last 2019 point 2019-12-31 – actual 190,871,871, model 171,718,795 (abs error 10.0%, best model: Ridge\_Lag).
- Unappropriated\_Profit: last 2019 point 2019-12-31 – actual 77,335,249, model 77,499,448 (abs error 0.2%, best model: SARIMAX\_X).

## Model Selection Logic

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For each Key Performance Indicator (KPI), three different forecasting models were developed and evaluated:

- Naive Random Walk Model
- SARIMAX Model with Macroeconomic Drivers  
(CPI Inflation, GDP Growth, Policy Rate, USD/PKR Exchange Rate)
- Ridge Regression Model using Lagged KPI Features

All models were trained using quarterly historical data from 2014-2018.  
Model performance was then assessed using a 2019 backtesting period, where the model forecasts were compared against the actual 2019 values.

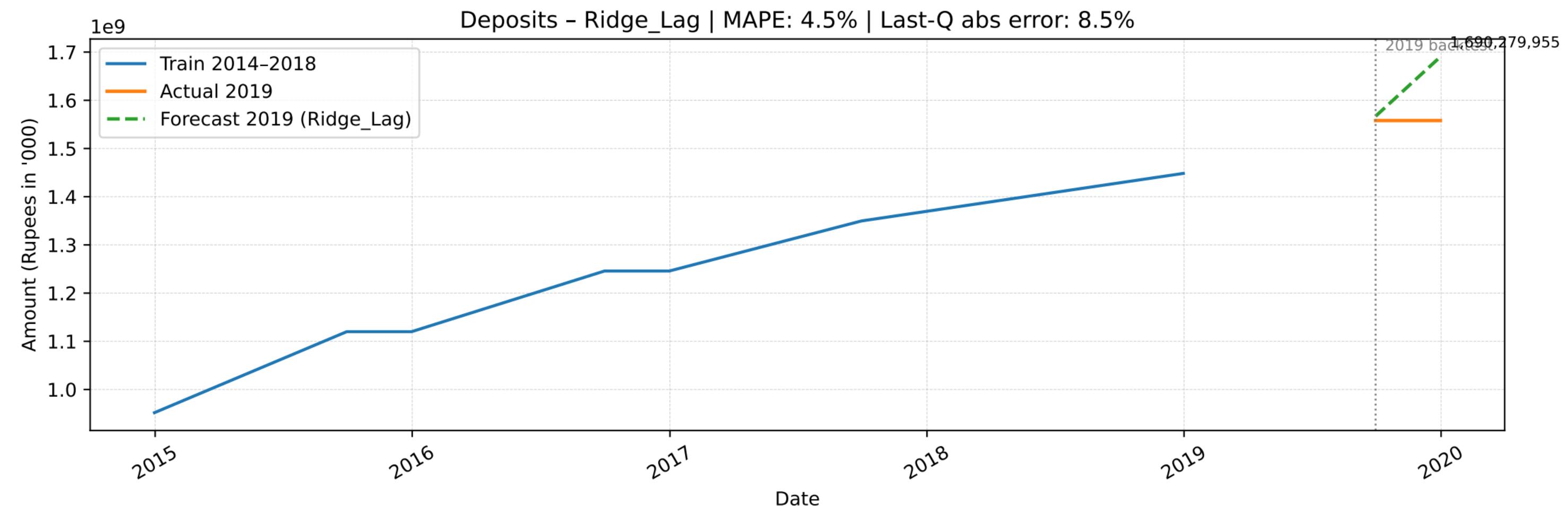
The Mean Absolute Percentage Error (MAPE) was used as the primary accuracy metric.  
For each KPI, the model with the lowest MAPE score on the 2019 backtest was selected as the preferred forecasting model.

An exception was applied to the Borrowings KPI. Borrowings tend to exhibit policy-driven volatility and sensitivity to quarter-end balance sheet adjustments.  
Therefore, in addition to MAPE, priority was given to minimising the absolute percentage error at the last quarter of 2019 (31-Dec-2019) to ensure end-period forecast stability and realism.

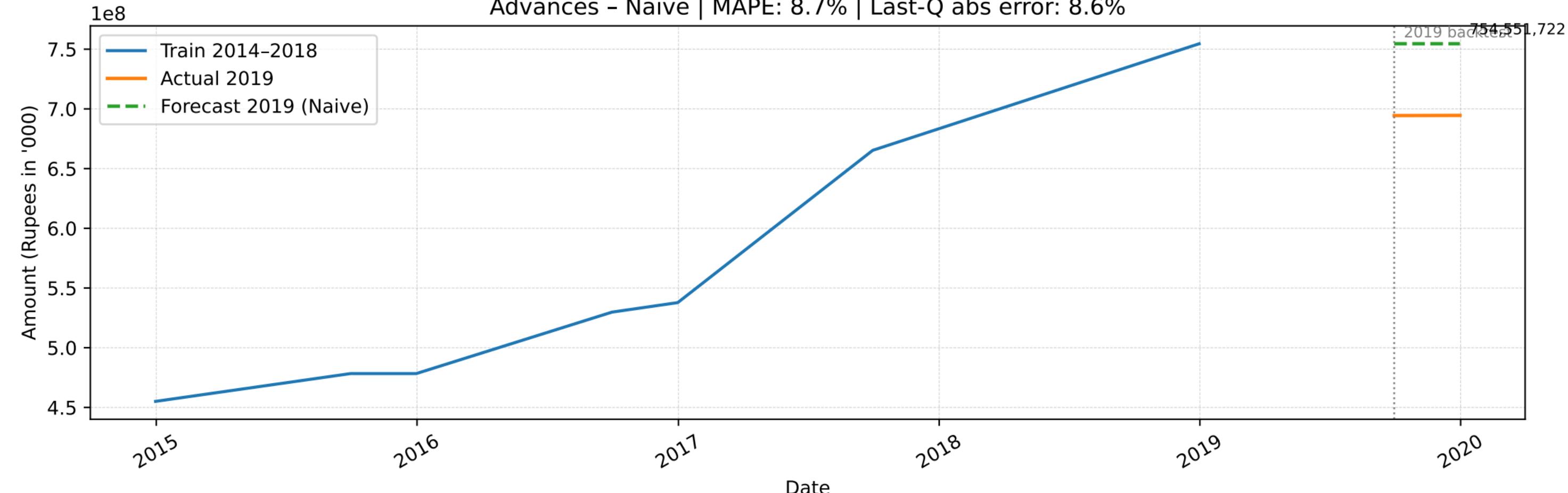
This structured and transparent model-selection process ensures that the final chosen forecasts are:

- ✓ Data-driven
- ✓ Benchmark-validated
- ✓ Performance-optimised
- ✓ Interpretable and replicable

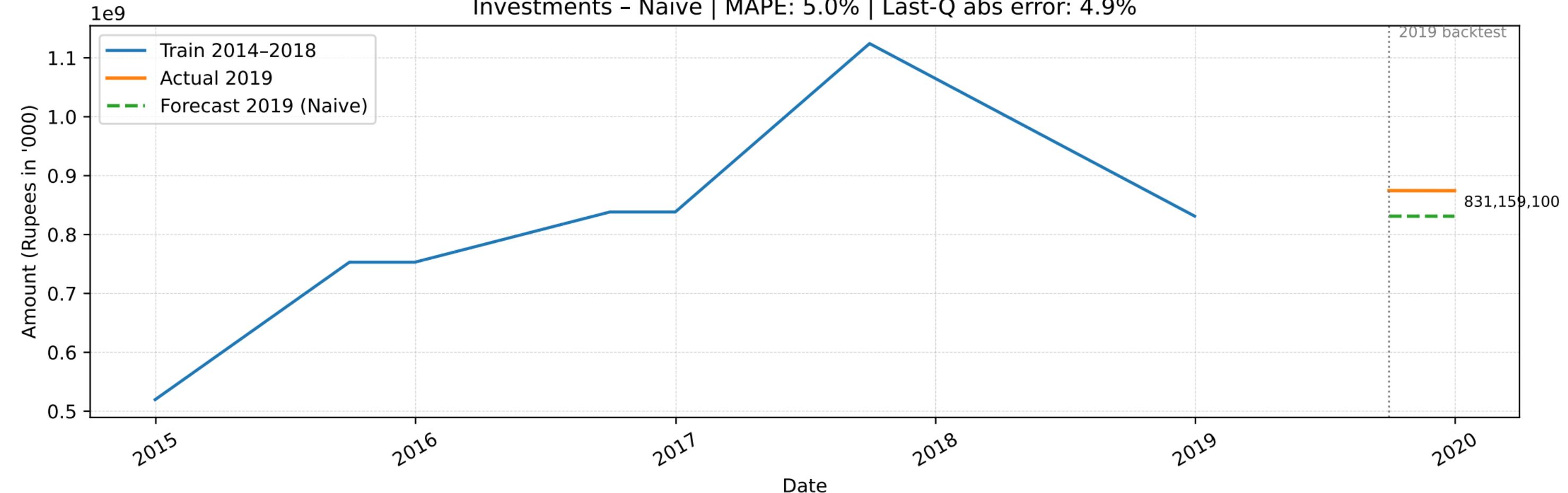
# Deposits - Ridge\_Lag | MAPE: 4.5% | Last-Q abs error: 8.5%



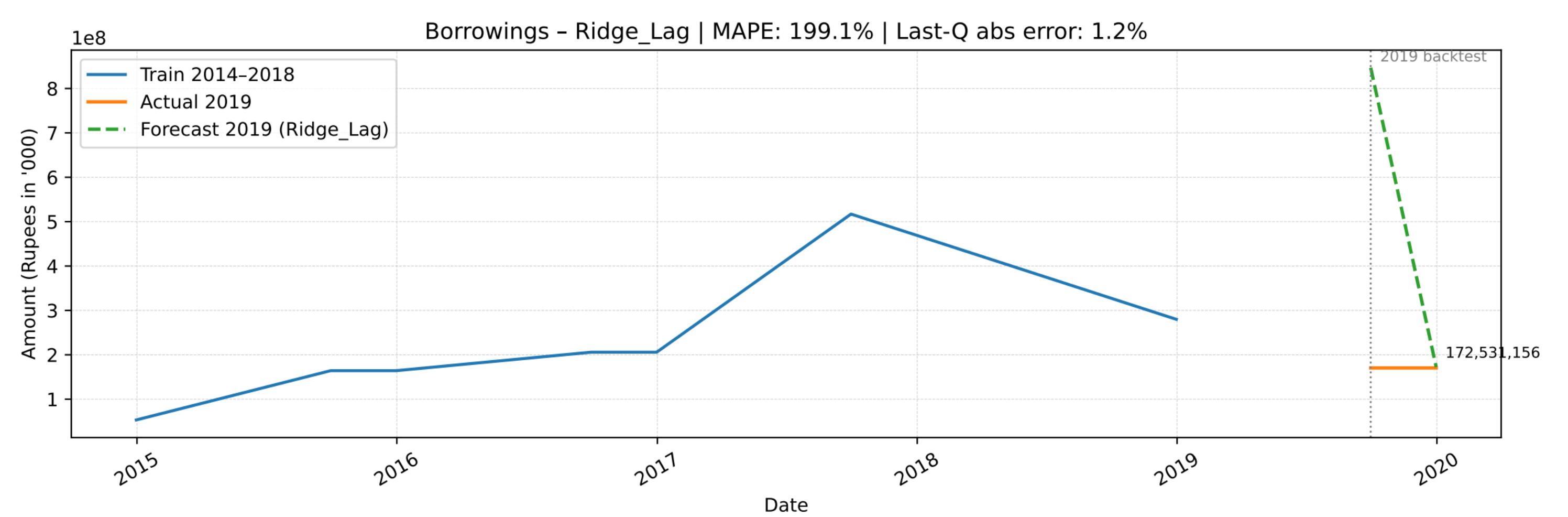
# Advances - Naive | MAPE: 8.7% | Last-Q abs error: 8.6%



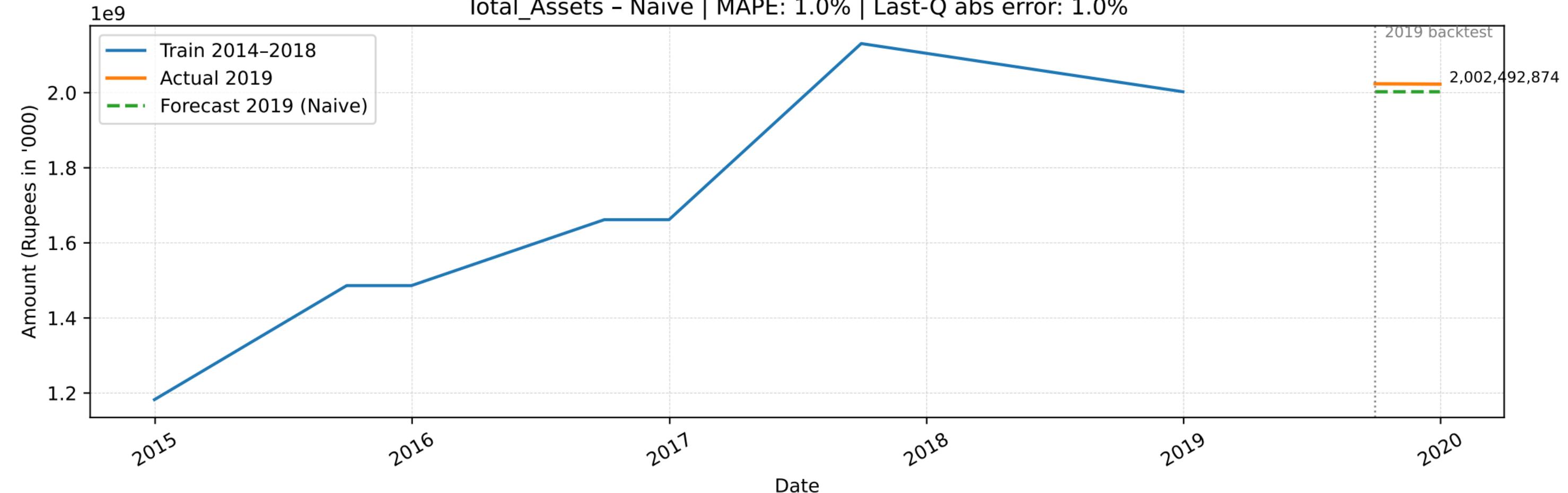
# Investments - Naive | MAPE: 5.0% | Last-Q abs error: 4.9%



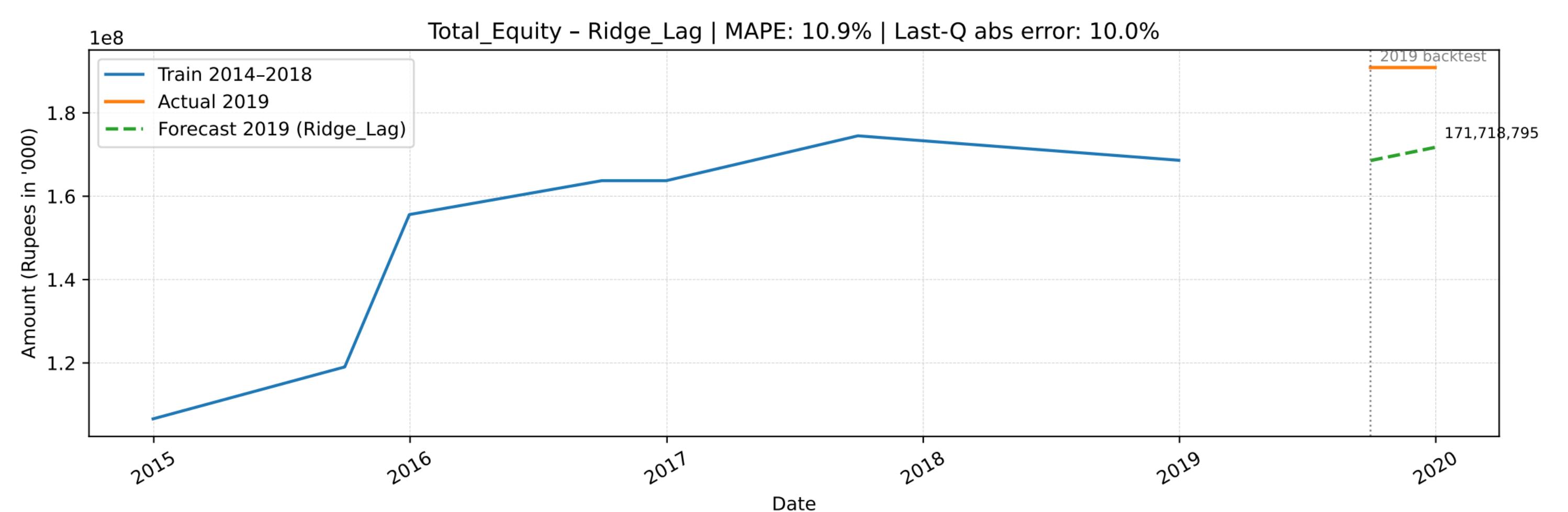
# Borrowings - Ridge\_Lag | MAPE: 199.1% | Last-Q abs error: 1.2%



# Total\_Assets - Naive | MAPE: 1.0% | Last-Q abs error: 1.0%



# Total\_Equity - Ridge\_Lag | MAPE: 10.9% | Last-Q abs error: 10.0%



# Unappropriated\_Profit - SARIMAX\_X | MAPE: 1.4% | Last-Q abs error: 0.2%

