fm-project

November 25, 2024

[32]:
```
import pandas_datareader as pdr
import pandas as pd
from darts import TimeSeries
from darts.models import LinearRegressionModel, Prophet
import matplotlib.pyplot as plt
```

[33]:
```
# Function to fetch exchange rates and inflation rates
def fetch_data(exchange_ticker, inflation_ticker, start='2012-01-01'):
    # Fetch data
    exchange_df = pdr.DataReader(exchange_ticker, 'fred', start=start).dropna()
    inflation_df = pdr.DataReader(inflation_ticker, 'fred', start=start).
 ↪dropna()

    # Resample monthly
    exchange_df = exchange_df.resample('M').last()
    inflation_df = inflation_df.resample('M').last()

    # Rename columns for clarity
    exchange_df.rename(columns={exchange_df.columns[0]: 'ExchangeRate'},␣
 ↪inplace=True)
    inflation_df.rename(columns={inflation_df.columns[0]: 'Inflation'},␣
 ↪inplace=True)

    # Merge on date
    data = pd.merge(exchange_df, inflation_df, left_index=True,␣
 ↪right_index=True)
    return data
```

[34]:
```
# Function to forecast and plot exchange rates
def forecast_and_plot(exchange_ticker, inflation_ticker, currency_label,␣
 ↪lags=12):
    # Fetch data
    data = fetch_data(exchange_ticker, inflation_ticker)

    # Add lagged features
    for i in range(1, lags + 1):
        data[f'Lag_{i}'] = data['ExchangeRate'].shift(i)
```

```
    data = data.dropna()  # Drop NaN rows caused by lagging

    # Convert to Darts TimeSeries
    series = TimeSeries.from_dataframe(data, value_cols='ExchangeRate',␣
↪freq='M')
    inflation_series = TimeSeries.from_dataframe(data, value_cols='Inflation',␣
↪freq='M')
    features = TimeSeries.from_dataframe(data[[f'Lag_{i}' for i in range(1,␣
↪lags + 1)] + ['Inflation']], freq='M')

    # Train-test split
    train, val = series.split_before(0.9)
    features_train, features_val = features.split_before(0.9)

    # Prophet Model
    prophet_model = Prophet()
    prophet_model.fit(train)
    prophet_forecast = prophet_model.predict(len(val))

    # Linear Regression Model
    linear_model = LinearRegressionModel(lags=lags)
    linear_model.fit(series=train)
    linear_forecast = linear_model.predict(len(val))

    # Print forecast values for Prophet and Linear Regression
    print(f"\n{currency_label} - Prophet Forecast:")
    print(prophet_forecast.pd_dataframe())

    print(f"\n{currency_label} - Linear Regression Forecast:")
    print(linear_forecast.pd_dataframe())

    # Plot Predictions
    plt.figure(figsize=(10, 6))
    train.plot(label=f'{currency_label} - Train Data', lw=1)
    val.plot(label=f'{currency_label} - Actual Data', lw=2)
    prophet_forecast.plot(label=f'{currency_label} - Prophet Forecast', lw=2)
    linear_forecast.plot(label=f'{currency_label} - Linear Regression␣
↪Forecast', lw=2)
    plt.title(f'{currency_label} - Exchange Rate Forecast')
    plt.xlabel('Date')
    plt.ylabel('Exchange Rate')
    plt.legend()
    plt.grid()
    plt.show()
```

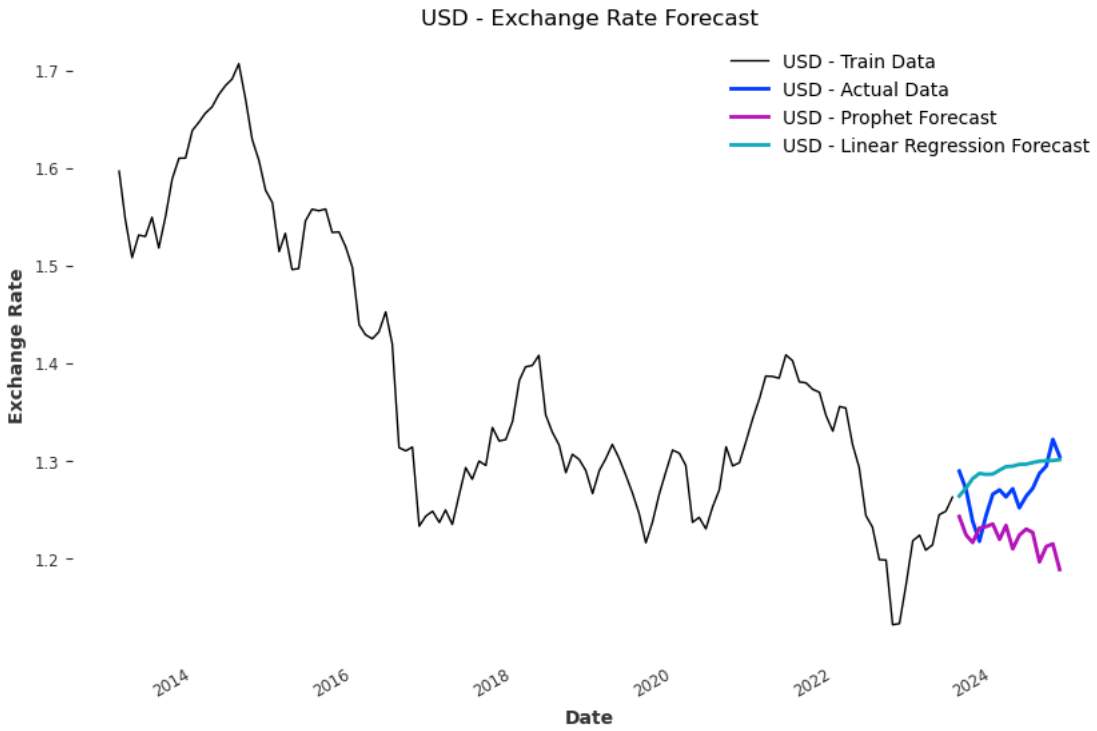
[35]:
```
# Forecast for USD
forecast_and_plot('EXUSUK', 'USACPIALLMINMEI', 'USD')
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:8: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  exchange_df = exchange_df.resample('M').last()
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:9: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  inflation_df = inflation_df.resample('M').last()
16:34:26 - cmdstanpy - INFO - Chain [1] start processing
16:34:26 - cmdstanpy - INFO - Chain [1] done processing


USD - Prophet Forecast:
component   ExchangeRate
DATE
2023-07-31      1.242841
2023-08-31      1.224041
2023-09-30      1.216232
2023-10-31      1.231039
2023-11-30      1.232470
2023-12-31      1.235192
2024-01-31      1.219418
2024-02-29      1.233779
2024-03-31      1.209702
2024-04-30      1.223689
2024-05-31      1.229972
2024-06-30      1.226546
2024-07-31      1.196387
2024-08-31      1.212209
2024-09-30      1.214810
2024-10-31      1.188522

USD - Linear Regression Forecast:
component   ExchangeRate
DATE
2023-07-31      1.263924
2023-08-31      1.272020
2023-09-30      1.281636
2023-10-31      1.287022
2023-11-30      1.285955
2023-12-31      1.286321
2024-01-31      1.290390
2024-02-29      1.293946
2024-03-31      1.294415
2024-04-30      1.296285
2024-05-31      1.296473
2024-06-30      1.298045
2024-07-31      1.299545
```

```
2024-08-31       1.300051
2024-09-30       1.300212
2024-10-31       1.301108
```



[36]:
```
# Forecast for EUR
forecast_and_plot('EXUSEU', 'GBRCPIALLMINMEI', 'EUR')
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:8: FutureWarning:
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instead.
  exchange_df = exchange_df.resample('M').last()
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:9: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  inflation_df = inflation_df.resample('M').last()
16:34:28 - cmdstanpy - INFO - Chain [1] start processing
16:34:28 - cmdstanpy - INFO - Chain [1] done processing


EUR - Prophet Forecast:
component   ExchangeRate
DATE
2023-07-31       1.054406
2023-08-31       1.058288
2023-09-30       1.057430
```
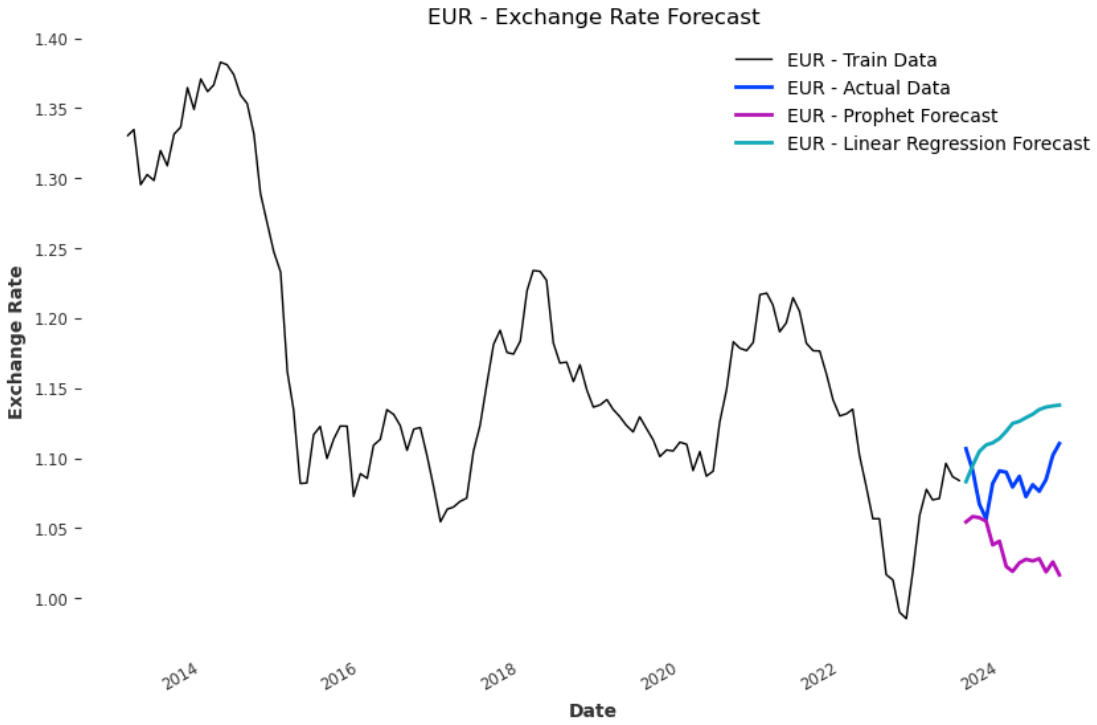

```
2023-10-31      1.054973
2023-11-30      1.038016
2023-12-31      1.040634
2024-01-31      1.022559
2024-02-29      1.019043
2024-03-31      1.025168
2024-04-30      1.027759
2024-05-31      1.026570
2024-06-30      1.028151
2024-07-31      1.018739
2024-08-31      1.025789
2024-09-30      1.016568

EUR - Linear Regression Forecast:
component   ExchangeRate
DATE
2023-07-31      1.083163
2023-08-31      1.094863
2023-09-30      1.104740
2023-10-31      1.109356
2023-11-30      1.110913
2023-12-31      1.113986
2024-01-31      1.119146
2024-02-29      1.124762
2024-03-31      1.126273
2024-04-30      1.128838
2024-05-31      1.131328
2024-06-30      1.134716
2024-07-31      1.136418
2024-08-31      1.137260
2024-09-30      1.137857
```



[37]:
```
# Forecast for CNY (China)
forecast_and_plot('EXCHUS', 'CHNCPIALLMINMEI', 'CNY')
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:8: FutureWarning:
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instead.
  exchange_df = exchange_df.resample('M').last()
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:9: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  inflation_df = inflation_df.resample('M').last()
16:34:30 - cmdstanpy - INFO - Chain [1] start processing
16:34:30 - cmdstanpy - INFO - Chain [1] done processing


CNY - Prophet Forecast:
component   ExchangeRate
DATE
2023-07-31      6.826080
2023-08-31      6.903834
2023-09-30      6.925373
2023-10-31      6.929485
2023-11-30      6.912687
2023-12-31      6.928910
```
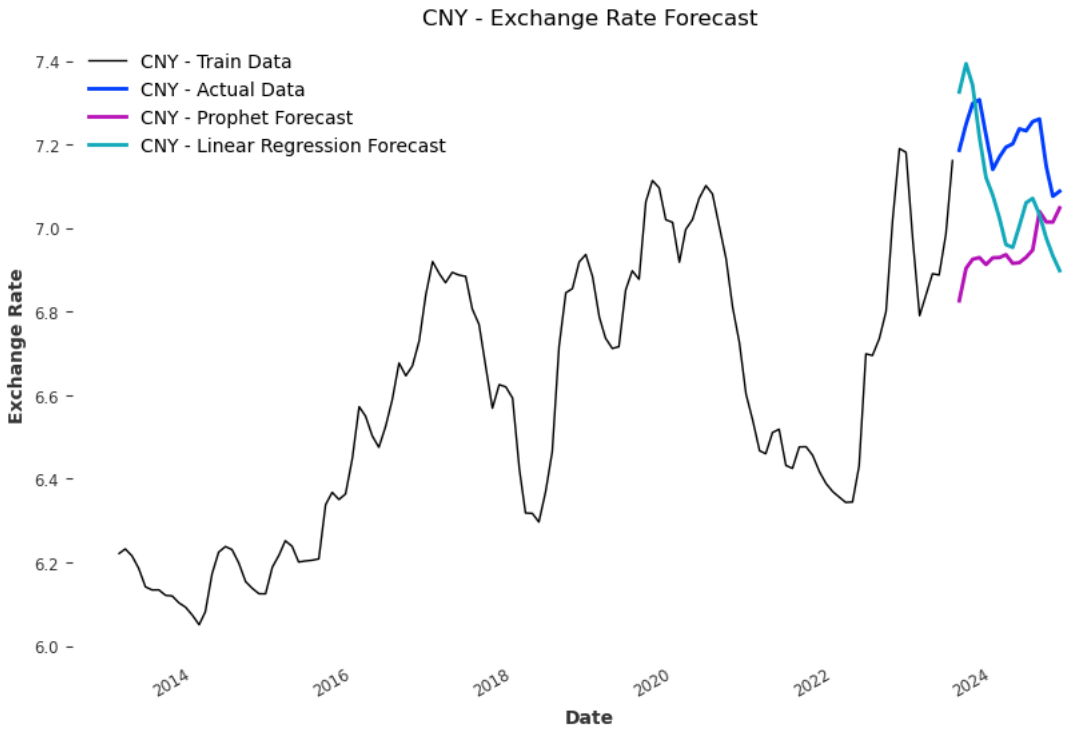
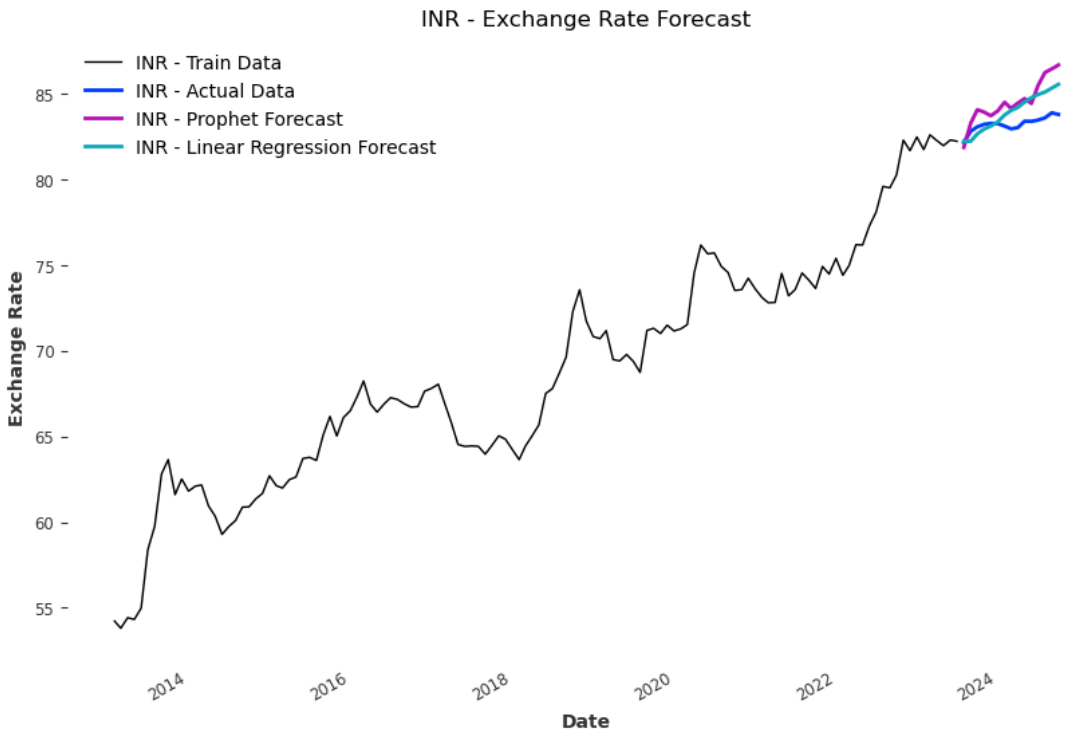

```
2024-01-31      6.929513
2024-02-29      6.936384
2024-03-31      6.915497
2024-04-30      6.917203
2024-05-31      6.930083
2024-06-30      6.947473
2024-07-31      7.039570
2024-08-31      7.014705
2024-09-30      7.014271
2024-10-31      7.048085

CNY - Linear Regression Forecast:
component   ExchangeRate
DATE
2023-07-31      7.325588
2023-08-31      7.393168
2023-09-30      7.341783
2023-10-31      7.218152
2023-11-30      7.121000
2023-12-31      7.078360
2024-01-31      7.022752
2024-02-29      6.960444
2024-03-31      6.953627
2024-04-30      7.004600
2024-05-31      7.060560
2024-06-30      7.070977
2024-07-31      7.032042
2024-08-31      6.975841
2024-09-30      6.933480
2024-10-31      6.898180
```



[38]:
```
# Forecast for INR
forecast_and_plot('EXINUS', 'INDCPIALLMINMEI', 'INR')
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:8: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  exchange_df = exchange_df.resample('M').last()
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:9: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  inflation_df = inflation_df.resample('M').last()
16:34:32 - cmdstanpy - INFO - Chain [1] start processing
16:34:32 - cmdstanpy - INFO - Chain [1] done processing


INR - Prophet Forecast:
component   ExchangeRate
DATE
2023-07-31     81.865822
2023-08-31     83.278004
2023-09-30     84.068310
2023-10-31     83.924030
2023-11-30     83.711575
2023-12-31     83.994339
```

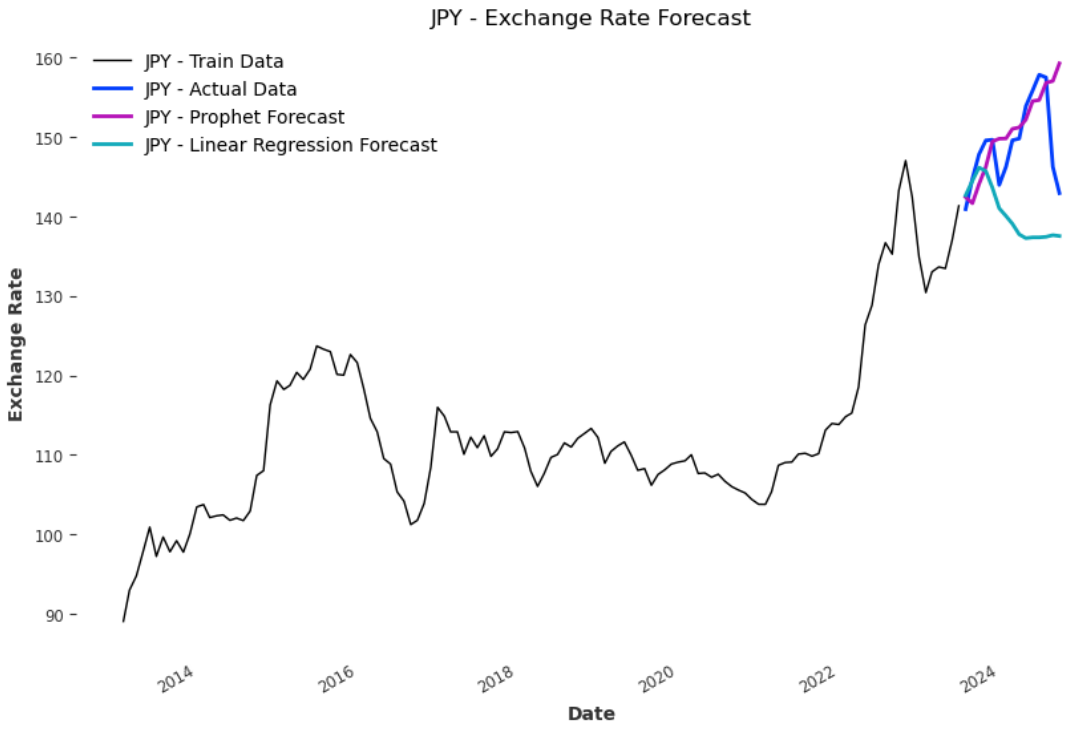
```
2024-01-31     84.499509
2024-02-29     84.147630
2024-03-31     84.453216
2024-04-30     84.713867
2024-05-31     84.431066
2024-06-30     85.481611
2024-07-31     86.233509
2024-08-31     86.448672
2024-09-30     86.674848

INR - Linear Regression Forecast:
component   ExchangeRate
DATE
2023-07-31     82.231576
2023-08-31     82.223630
2023-09-30     82.658821
2023-10-31     82.938023
2023-11-30     83.116297
2023-12-31     83.356337
2024-01-31     83.758271
2024-02-29     84.017417
2024-03-31     84.200866
2024-04-30     84.509030
2024-05-31     84.770282
2024-06-30     84.951663
2024-07-31     85.095276
2024-08-31     85.326248
2024-09-30     85.548539
```



[39]:
```
# Forecast for JPY
forecast_and_plot('EXJPUS', 'CANCPIALLMINMEI', 'JPY')
```

```
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:8: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  exchange_df = exchange_df.resample('M').last()
C:\Users\HP\AppData\Local\Temp\ipykernel_14540\1907734901.py:9: FutureWarning:
'M' is deprecated and will be removed in a future version, please use 'ME'
instead.
  inflation_df = inflation_df.resample('M').last()
16:34:35 - cmdstanpy - INFO - Chain [1] start processing
16:34:35 - cmdstanpy - INFO - Chain [1] done processing


JPY - Prophet Forecast:
component   ExchangeRate
DATE
2023-07-31    142.453765
2023-08-31    141.682994
2023-09-30    144.086992
2023-10-31    146.265930
2023-11-30    149.473091
2023-12-31    149.804745
```

```
2024-01-31    149.836640
2024-02-29    151.049015
2024-03-31    151.225844
2024-04-30    152.199790
2024-05-31    154.538258
2024-06-30    154.674683
2024-07-31    156.835844
2024-08-31    157.068113
2024-09-30    159.288418

JPY - Linear Regression Forecast:
component   ExchangeRate
DATE
2023-07-31    142.676719
2023-08-31    144.511987
2023-09-30    146.176302
2023-10-31    145.733181
2023-11-30    143.631340
2023-12-31    141.043789
2024-01-31    140.068095
2024-02-29    139.096577
2024-03-31    137.764908
2024-04-30    137.288078
2024-05-31    137.387292
2024-06-30    137.388670
2024-07-31    137.457082
2024-08-31    137.668250
2024-09-30    137.555809
```


JPY - Exchange Rate Forecast
JPY - Train Data
JPY - Actual Data
JPY - Prophet Forecast
JPY - Linear Regression Forecast
Exchange Rate
160
150
140
130
120
110
100
90
2014
2016
2018
2020
2022
2024
Date

[ ]: