

Predicting USD ↔ YEN Rates

Time Series Forecasting Using
ARMA and ARIMA Models

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HISTORICAL RATES

Yen Through The Years

JPY HISTORY



**Jan.
1971**

ALL TIME HIGH

JPY enters the FOREX
market at 357.72 per
USD



**Oct.
2011**

ALL TIME LOW

JPY hits its historical
low of 75.72 per USD



**Jan. - Dec.
2020**

START - END RANGE

Year opens at 121.03,
closes at 103.25



2021 -

???

Use ARMA/ARIMA
model to predict

Yen to USD Exchange Rate 2011 - 2021





ARMA Model

Results of the ARMA(2,1) Model

ARMA Model Results

```

=====
Dep. Variable:          yen      No. Observations:          2591
Model:                  ARMA(2, 1)  Log Likelihood          9976.201
Method:                  css-mle    S.D. of innovations      0.005
Date:                    Tue, 02 Feb 2021    AIC                      -19942.402
Time:                    11:21:27          BIC                      -19913.103
Sample:                  02-18-2011    HQIC                     -19931.785
                        - 01-22-2021
=====

```

```

=====
              coef      std err          z      P>|z|      [0.025      0.975]
-----
const          0.0009      0.001      0.895      0.371      -0.001      0.003
ar.L1.yen       1.7573      0.048     36.687      0.000       1.663      1.851
ar.L2.yen      -0.7808      0.043    -17.993      0.000      -0.866     -0.696
ma.L1.yen      -0.7771      0.054    -14.410      0.000      -0.883     -0.671
=====

```

Roots

```

=====
              Real          Imaginary      Modulus      Frequency
-----
AR.1          1.1253         -0.1204j         1.1317         -0.0170
AR.2          1.1253          +0.1204j         1.1317          0.0170
MA.1          1.2869          +0.0000j         1.2869          0.0000
=====

```

Log-Transformed Yen Value

2021-01-23	0.001371
2021-01-24	0.001315
2021-01-25	0.001261
2021-01-26	0.001209
2021-01-27	0.001160
2021-01-28	0.001115
2021-01-29	0.001073
2021-01-30	0.001036
2021-01-31	0.001002
2021-02-01	0.000972
2021-02-02	0.000946
2021-02-03	0.000924
2021-02-04	0.000905
2021-02-05	0.000888
2021-02-06	0.000875
2021-02-07	0.000864
2021-02-08	0.000855
2021-02-09	0.000848
2021-02-10	0.000843
2021-02-11	0.000839



Results are difficult to interpret:

- Log transformed
- Rolling mean subtracted

Can identify a downward trend

ARMA(2,1) 20-DAY FORECAST



ARIMA Model

Using ARIMA to simplify ARMA process

BRIEF OVERVIEW of ARIMA PROCESS

STEP 1

Make dataset
stationary



"Gridsearch" to
find best
parameters

STEP 2

STEP 3

Validate the
model

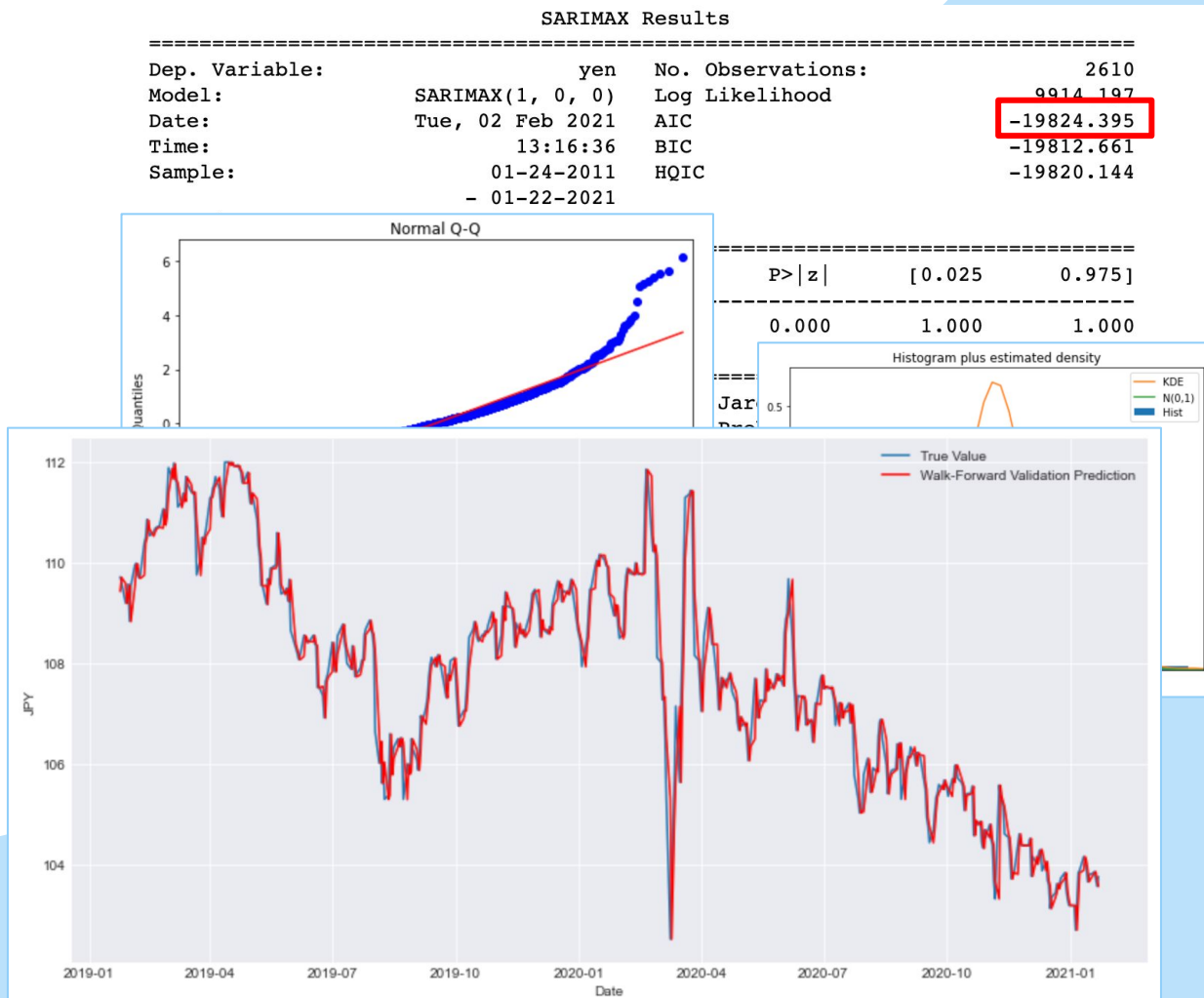


Forecast the
future

STEP 4

ARIMA(1,0,0) RESULTS

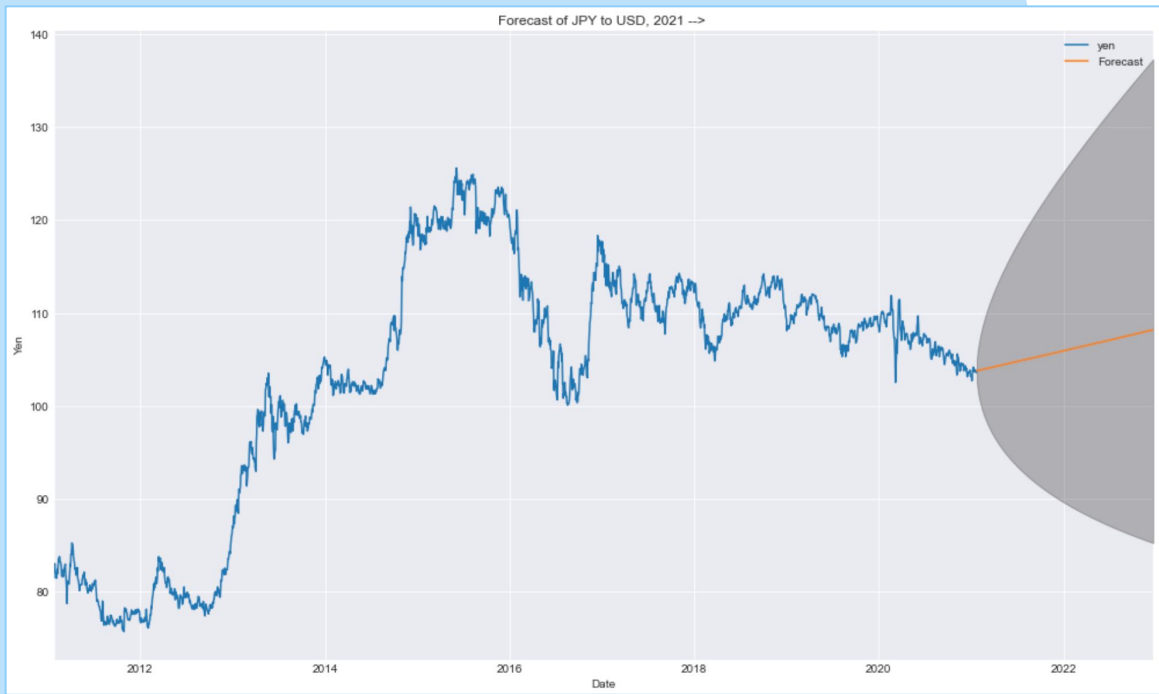
Results and Validation





FORECAST

Can this ARIMA model make you rich?



Not with a plot like this...



lower yen

upper yen

2022-01-03 89.643077 125.132536

ADVICE FOR FUTURE WORK



FEATURE ENGINEERING

Model only used previous
JPY price

Other currencies,
worldwide events, etc.



DATA CLEANING

Transform/explore data
to improve Q-Q and KDE
plots



FORECASTING

Clean up the forecast plot

Improve results to
decrease confidence
interval

A scenic photograph of Mount Fuji, a snow-capped mountain, centered in the background. The sky is a clear, vibrant blue. In the foreground, several branches of cherry blossoms with pink and white flowers are visible, framing the top and sides of the image. The overall composition is bright and cheerful.

Thank You!

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