

Steps to Prepare Data for Forecasting using ARIMA

1. Stationarity Testing:

- You began by checking stationarity through **ACF/PACF**, **ADF**, and **KPSS** tests. These methods help confirm the need for differencing (the Integrated part) to make the series stationary.

2. Applying Differencing (Integrated Component):

- You applied the Integrated (I) component (with order 1, or **I(1)**) to remove trends and seasonality, yielding a stationary series where the mean and variance remain constant. At this point, the goal is to remove any remaining non-stationary patterns, which often leaves us with stationary noise—ideally, white noise, if all dependencies are removed.

3. Addressing Remaining Dependencies with the Autoregressive (AR) Component:

- With the stationary series prepared, applying the **AR** component models the dependencies in the data using past lagged values. AR parameters capture these dependencies and help eliminate any further correlations between lags.

Now that the AR part has been applied, we turn to **Moving Average (MA)** to address any remaining dependencies in the residuals.

Applying the Moving Average (MA) Component

The Moving Average component is added to model **any remaining correlation in the error terms** (residuals) after applying differencing and the AR component. Here's how it works and why it's necessary:

1. Identifying MA Order (q):

- After applying AR, examine the **PACF plot** of the residuals. If there are spikes at certain lags, this indicates that some correlations remain in the error terms. These residual autocorrelations can be captured by the **MA** component.
- The **MA order (q)** represents the number of lagged forecast errors to include in the model. The PACF plot of the residuals guides you to select an appropriate MA order.

2. Adding the MA Terms:

- The MA component effectively smooths out remaining dependencies by applying a weighted average to the forecast errors at previous lags.
- This step adjusts the model so that the residuals (forecast errors) become as close to white noise as possible, meaning there should be no significant remaining autocorrelation in the residuals.

3. Refining the Model:

- After adding MA terms, evaluate the residuals again to confirm that the series behaves like white noise (i.e., no significant autocorrelation at any lag in the residuals). This indicates that the model now captures all the dependencies in the data.

Summary of Applying MA in ARIMA

The Moving Average component addresses any remaining structure in the residuals after differencing and autoregression. Once the MA terms are added, the series is typically ready for accurate forecasting, as ARIMA captures trends, seasonality, and all remaining dependencies effectively.