

Activity Solution: Model Fitting using Acf and Pacf

We have seen how useful the sample autocorrelation function (acf) and partial autocorrelation function (pacf) can be for determining the appropriate model for a time series. The goal of this activity is to use acf and pacf plots to determine the appropriate model for a given time series. Each row of the graphics reproduced below contains a plot of the time series (left), acf (middle), and pacf (right) plots. For each row:

- Determine if the series appears to be stationary. If not, identify what appears to be the departure from stationarity.
- If you have decided the series is from a stationary model, determine which would be the most appropriate model from: white noise, AR, MA, or ARMA. If possible try to identify the order of any ARMA model you propose.

Answer: The following shows the model used to generate the time series.

1. AR(5) – parameter vector $\alpha = (.9, -.4, .6, -.3, -.2)$
2. This could reasonably be mistaken for a non-stationary series with a seasonal component, but in fact was simulated from an ARMA(2,3) with parameters $\alpha = (.9, -.4)$, $\beta = (.6, .4, .3)$. Check whether this model *is* stationary.
3. This was an MA(6) with $\beta = (-.7, .7, -.6, .6, -.4, .4)$
4. White Noise
5. Trend (so nonstationary)
6. Seasonal effect of period 20
7. MA(5) – $\beta = (.8, .8, .8, .8, .8)$
8. Nonstationary.



