MONASH University

MONASH BUSINESS SCHOOL

Forecasting: principles and practice

Rob J Hyndman

1.1 Time series graphics

Time series in R

`ts` objects and `ts` function

A time series is stored in a `ts` object in R:

- a list of numbers
- information about times those numbers were recorded.

###Example

Year	Observation
2012	123
2013	39
2014	78
2015	52
2016	110

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y <- ts(c(123,39,78,52,110), start=2012)
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Time plots

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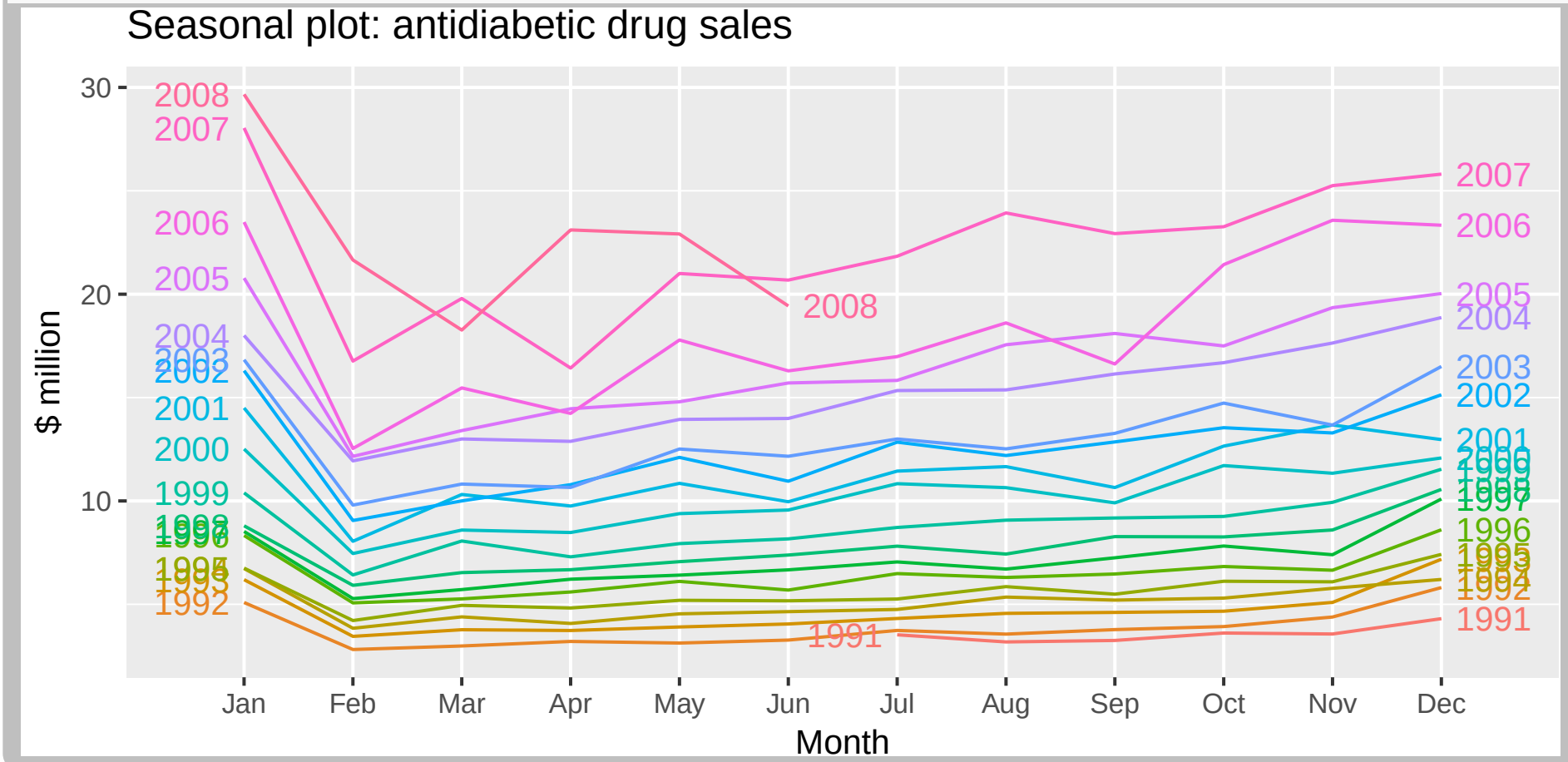
```
autoplot(melsyd[,"Economy.Class"])
```

Seasonal plots

Seasonal plots

```
ggseasonplot(a10, ylab="$ million",
  year.labels=TRUE, year.labels.left=TRUE) +
  ggtitle("Seasonal plot: antidiabetic drug sales")
```



Seasonal or cyclic?

##Time series patterns

Trend pattern exists when there is a long-term increase or decrease in the data.

Seasonal pattern exists when a series is influenced by seasonal factors (e.g., the quarter of the year, the month, or day of the week).

Cyclic pattern exists when data exhibit rises and falls that are *not of fixed period* (duration usually of at least 2 years).

##Time series components

###Differences between seasonal and cyclic patterns:

- seasonal pattern constant length; cyclic pattern

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Lag plots and autocorrelation

Example: Beer production

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beer <- window(ausbeer, start=1992)
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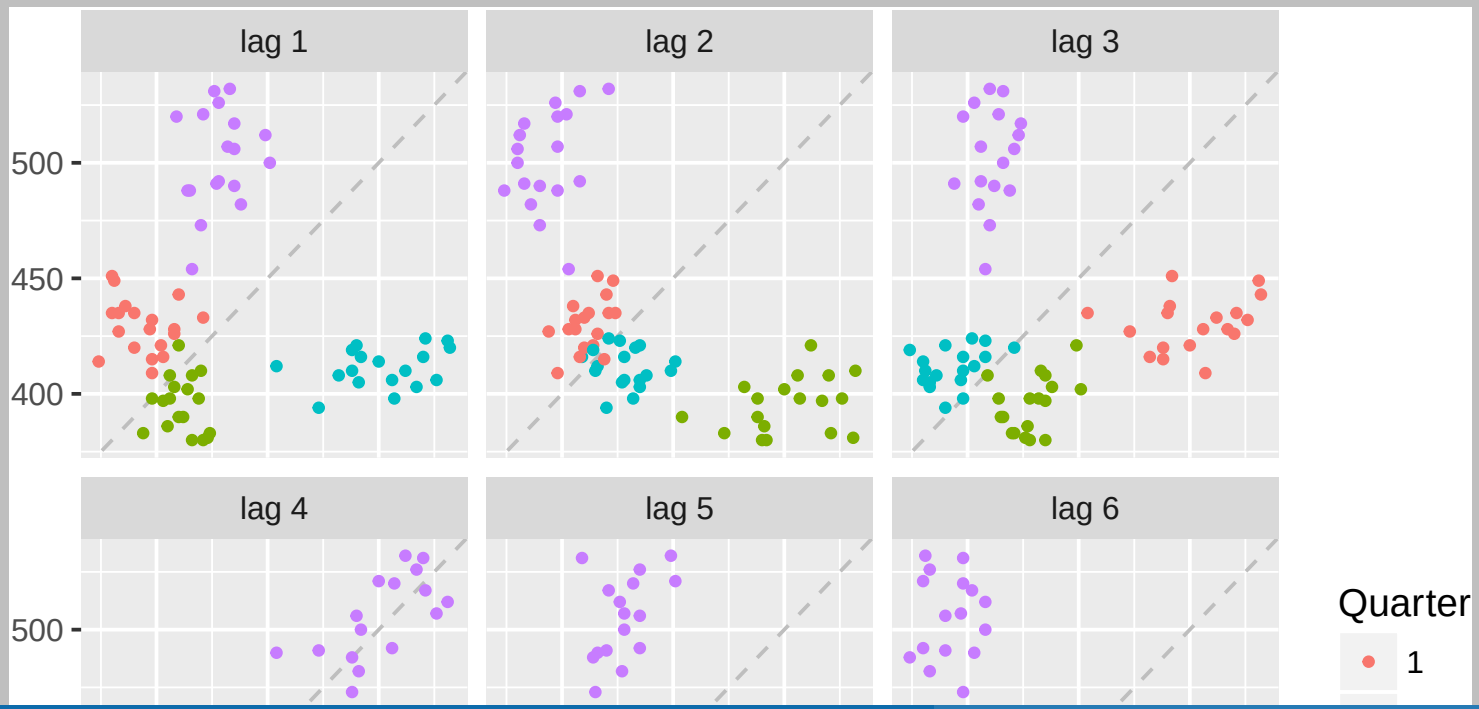

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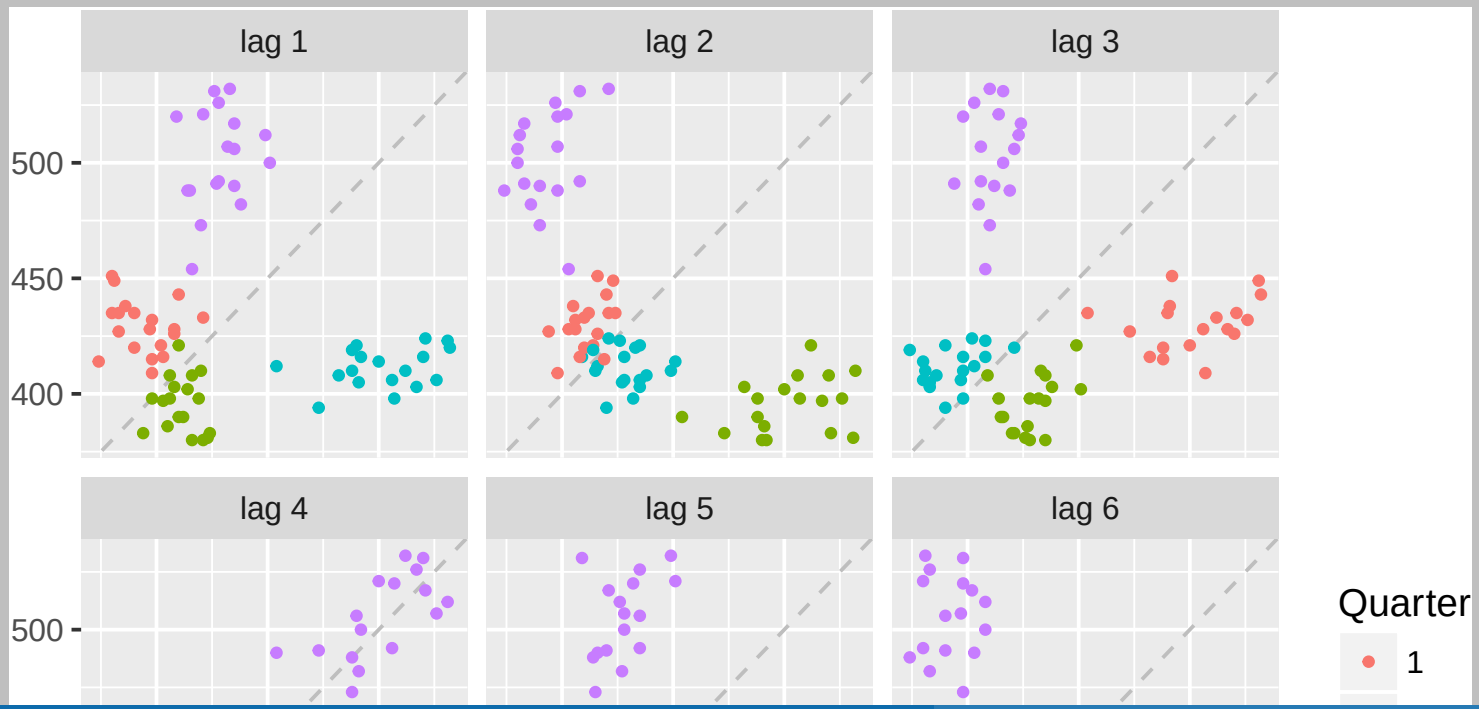

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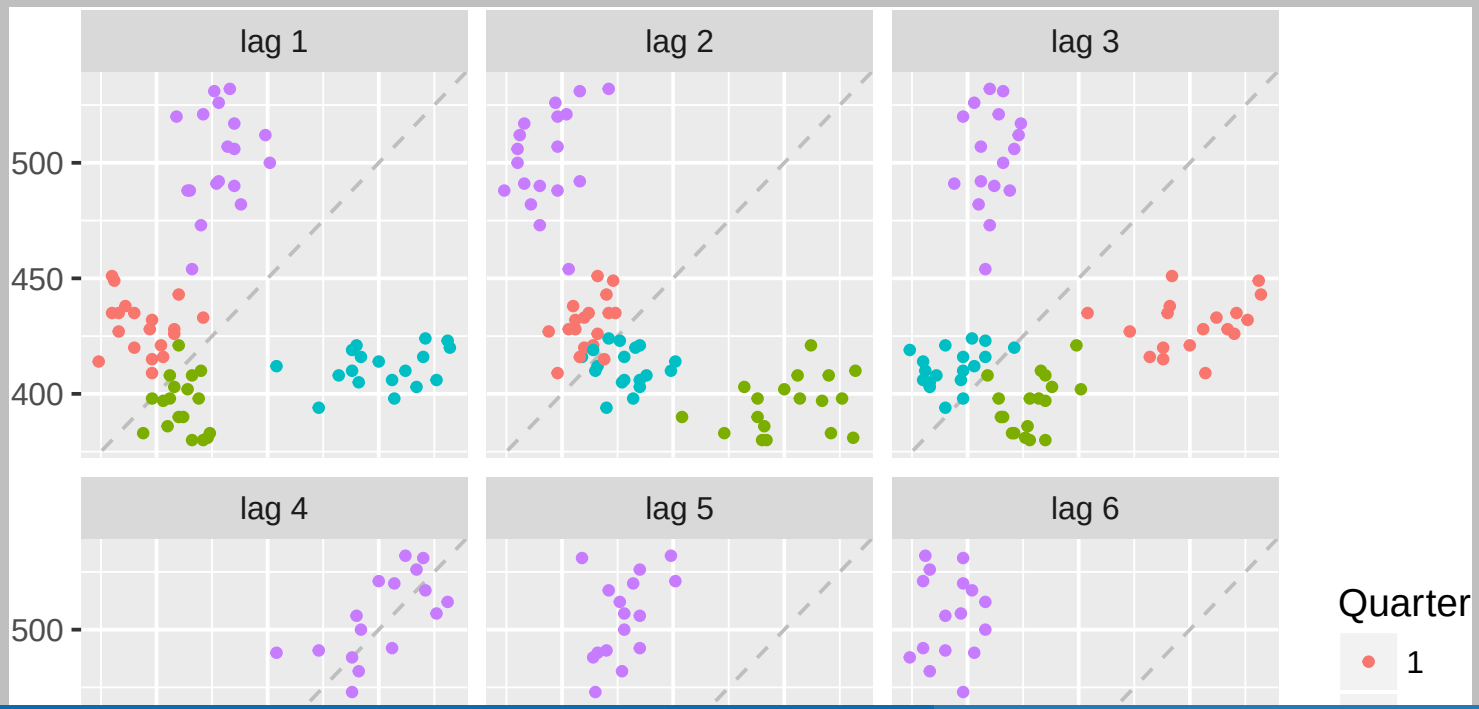

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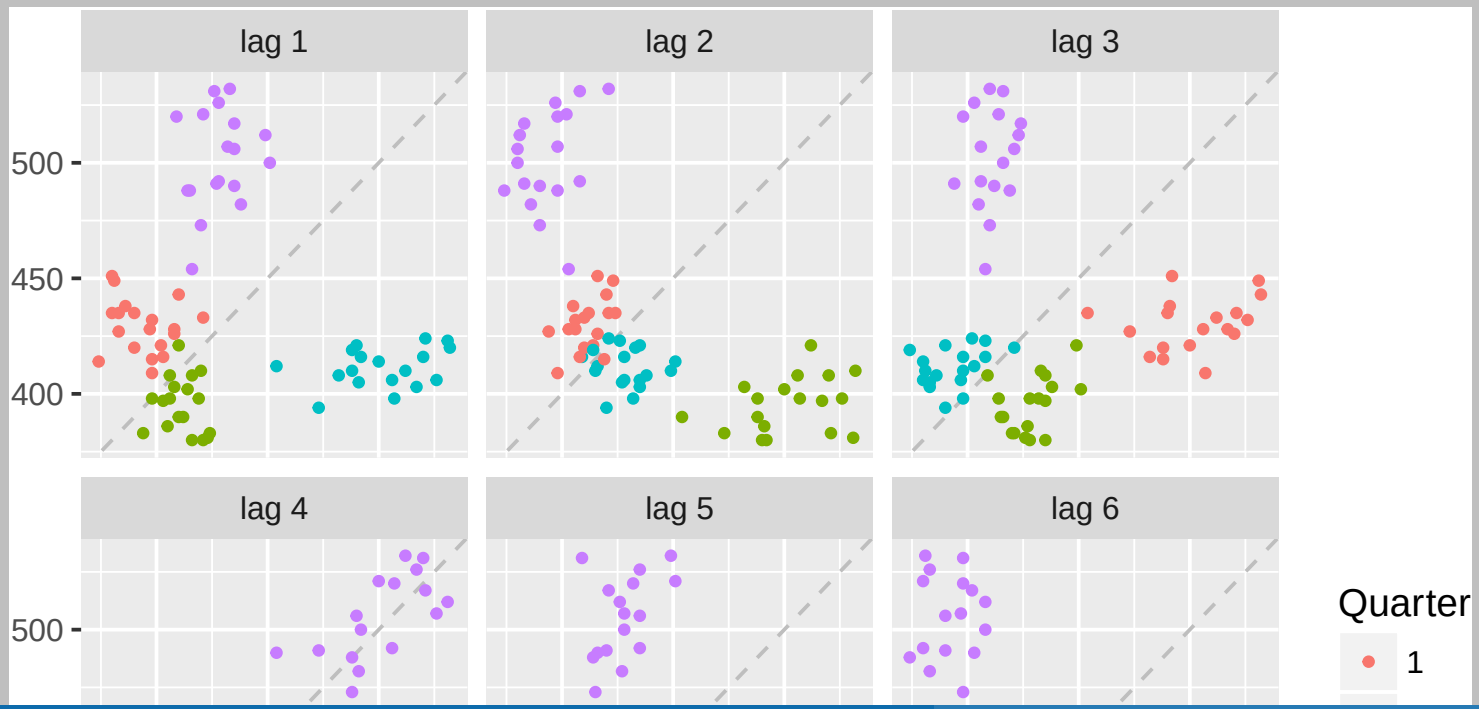

White noise

Example: White noise

Example:

```
wn <- ts(rnorm(
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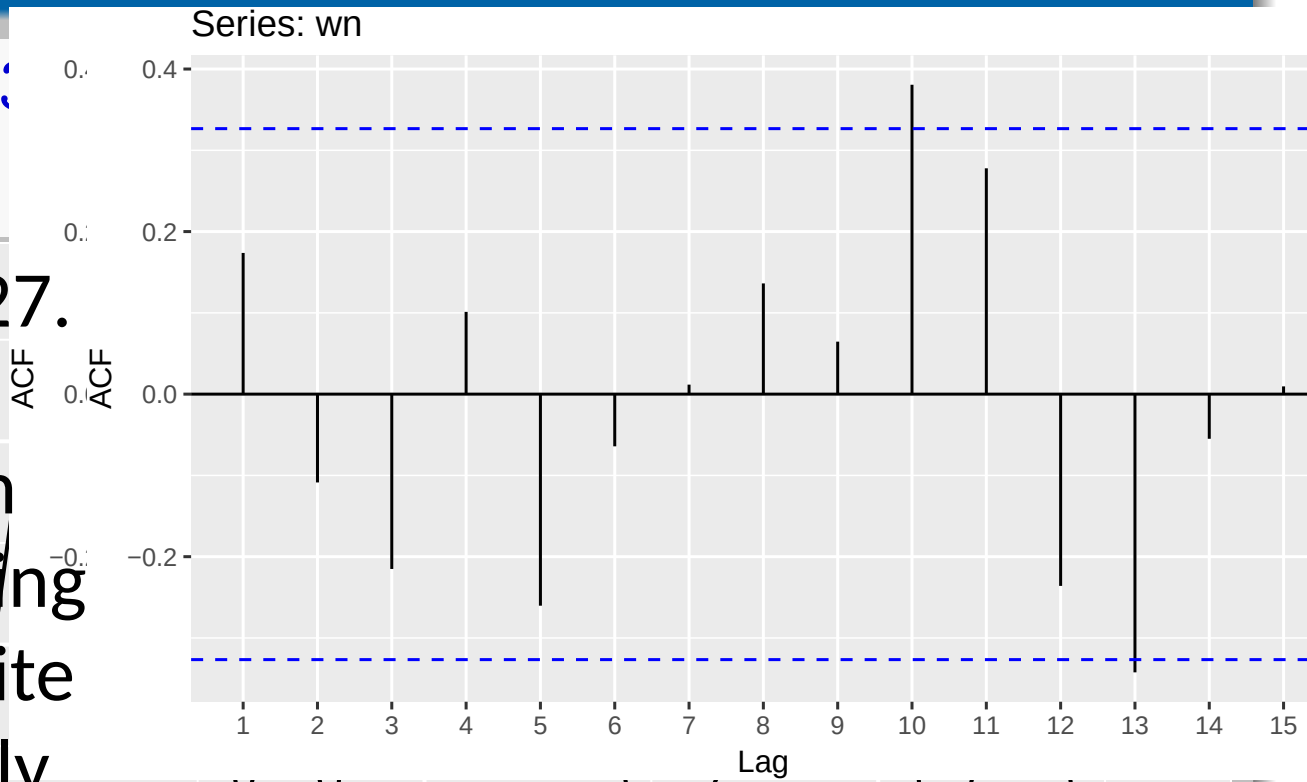
$T = 36$ and so critical values at $\pm 1.96/\sqrt{36} = \pm 0.327$. All autocorrelation coefficients lie within these limits, confirming that the data are white noise. (More precisely, the data cannot be distinguished from white noise.)



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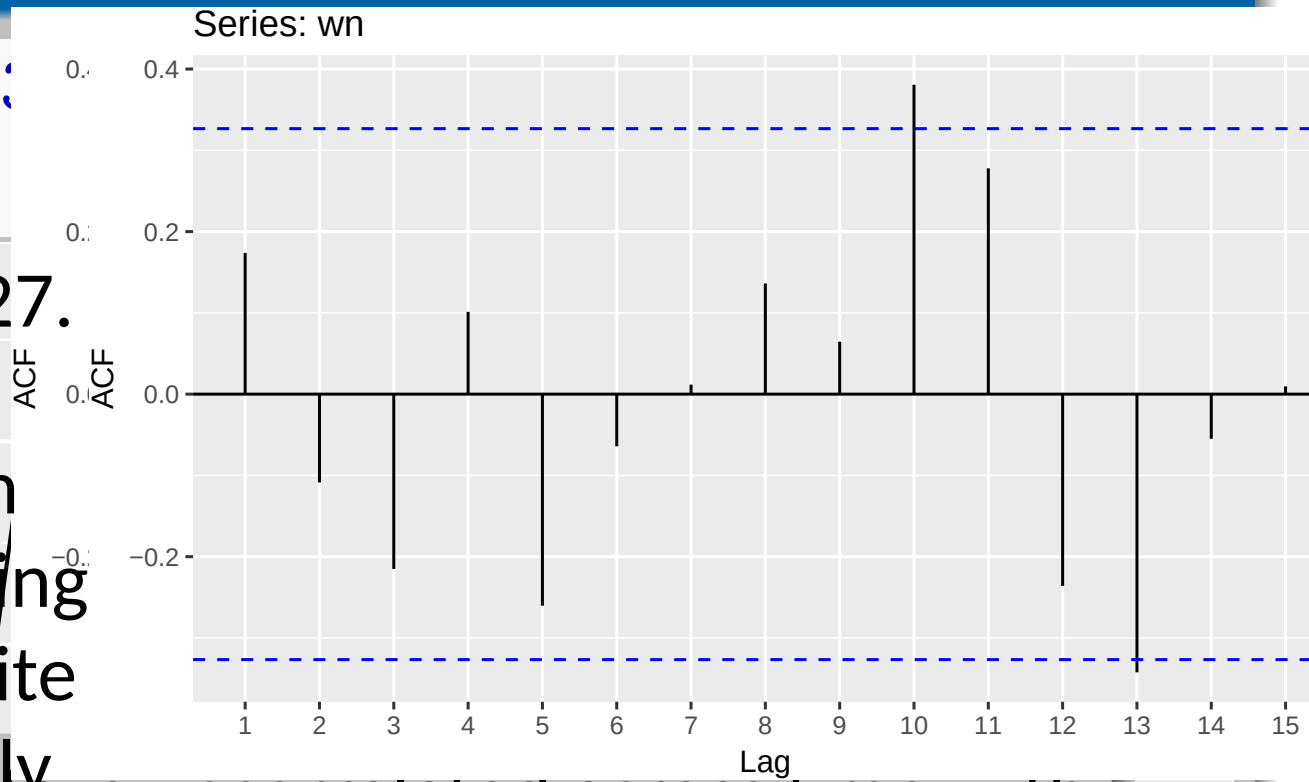

White noise data is uncorrelated across time with zero mean and constant variance. (Technically, we require independence as well.)

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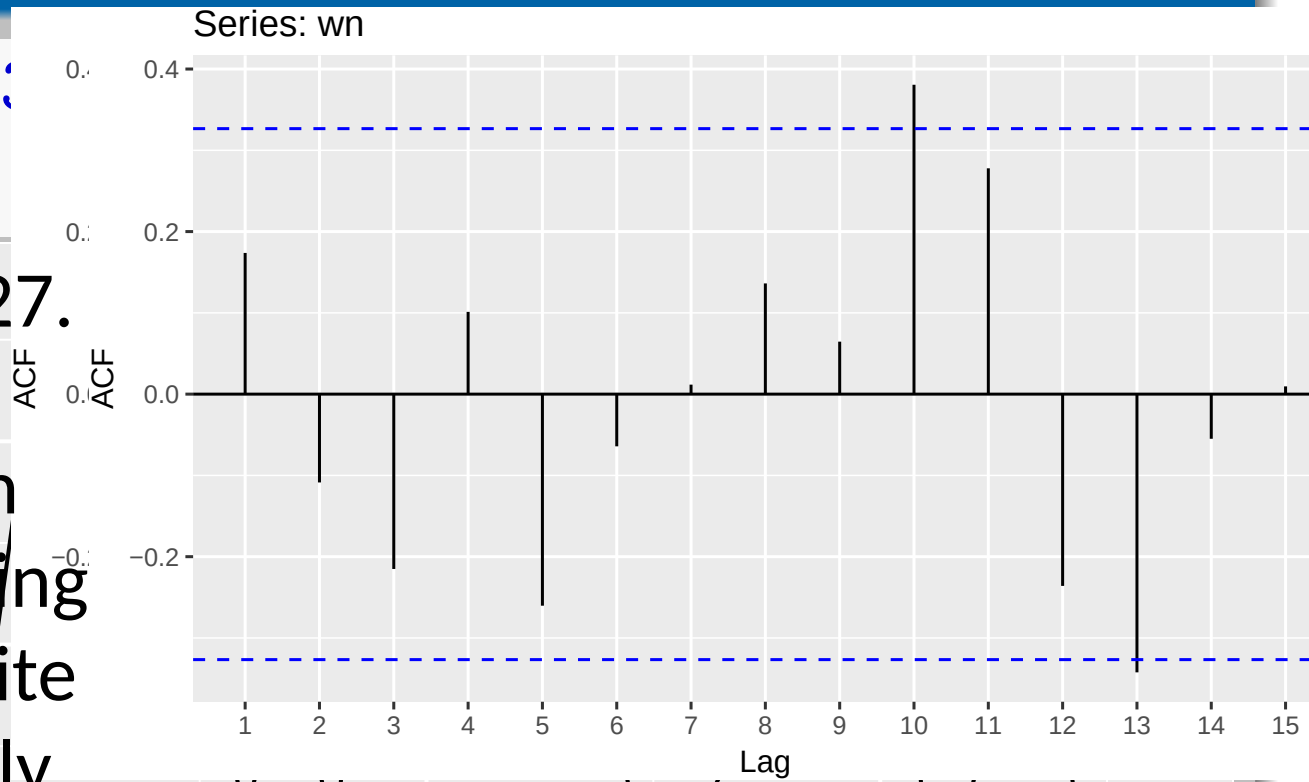

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