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Seasonal Adjustment with the R packages x12 and x12GUI

Motivation

- X12-ARIMA is widely used and state-of-the-art in many statistical offices
- Statistical offices (we) have to apply seasonal adjustment frequently and to many different time series
- Graphical analysis should always be included in the process
- Results should be reproducable and easy to modify
- (X-13-ARIMA-SEATS is the successor if X12-ARIMA, SEATS not yet implemented)

$\longrightarrow$ `R`-packages `x12` and `x12GUI`

Features

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Die Informationsmanager

- Access to X12-ARIMA directly from within R (no spc, out, . . . files)
- Class oriented command line interface
- Change tracking for the X12-ARIMA parameters and output
- Batch processing of multiple time series at once (in parallel)
- Easy generation of graphical output
- Import the parameter settings from spc files to R

Class x12Single

Objects of class x12Single contain the following information

- ts - The original time serie
- x12Parameter - The current X12-ARIMA parameter setting
- x12Output - The current X12-ARIMA results
- x12OldParameter - All previous X12-ARIMA parameter settings
- x12OldOutput - All previous X12-ARIMA results

Methods x12Single

Methods for this class are:

- x12 - (Re)Run X12-ARIMA
- setP,getP - Change/View parameters
- prev,cleanHistory - Revert to a previous X12 parameter setting and output
- plot,plotRsdAcf,plotSpec,plotSeasFac - Plot methods

```
s <- new("x12Single", ts = AirPassengers ,
  tsName = "air")
s <- x12(s)
forecast <- s@x12Output@forecast
```

Class x12Batch

Objects of class x12Batch

- Combination of multiple objects of class x12Single
- Inherit the methods from class x12Single

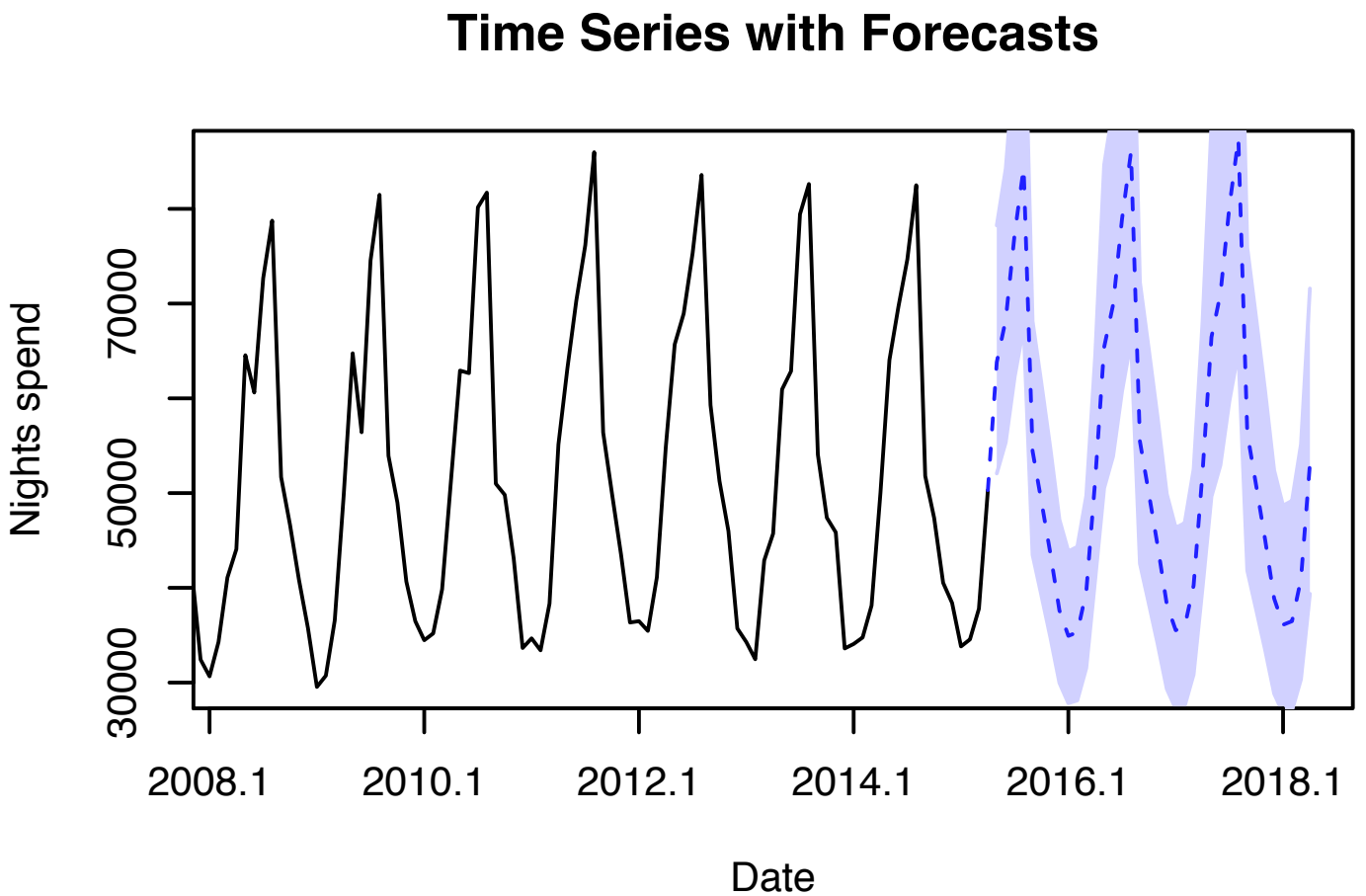
```
xb <- new("x12Batch", list(AirPassengers ,
  AirPassengers , AirPassengers ))
xb <- setP(xb, list(estimate = TRUE,
  outlier.types = "all")
xb <- setP(xb, list(outlier.types = "LS", index=1)
#options(x12.parallel=2)
xb <- x12(xb)
```

Real example Batch - Tourism

```
> dat <- read.csv2("http://bit.ly/1RTF31S")
> tsObject <- lapply(split(dat[,5], list(dat[,2], dat[,3])),
+ # by state and country of origin
+   ts,start = c(1973,11), frequency = 12)
> length(tsObject)

[1] 774

> xb <- new("x12Batch", tsObject[1:3])
> xb <- setP(xb,list(forecast_years=3))

The parameters for all objects are changed.

> xb <- x12(xb)

Time difference of 6.766999 secs
```

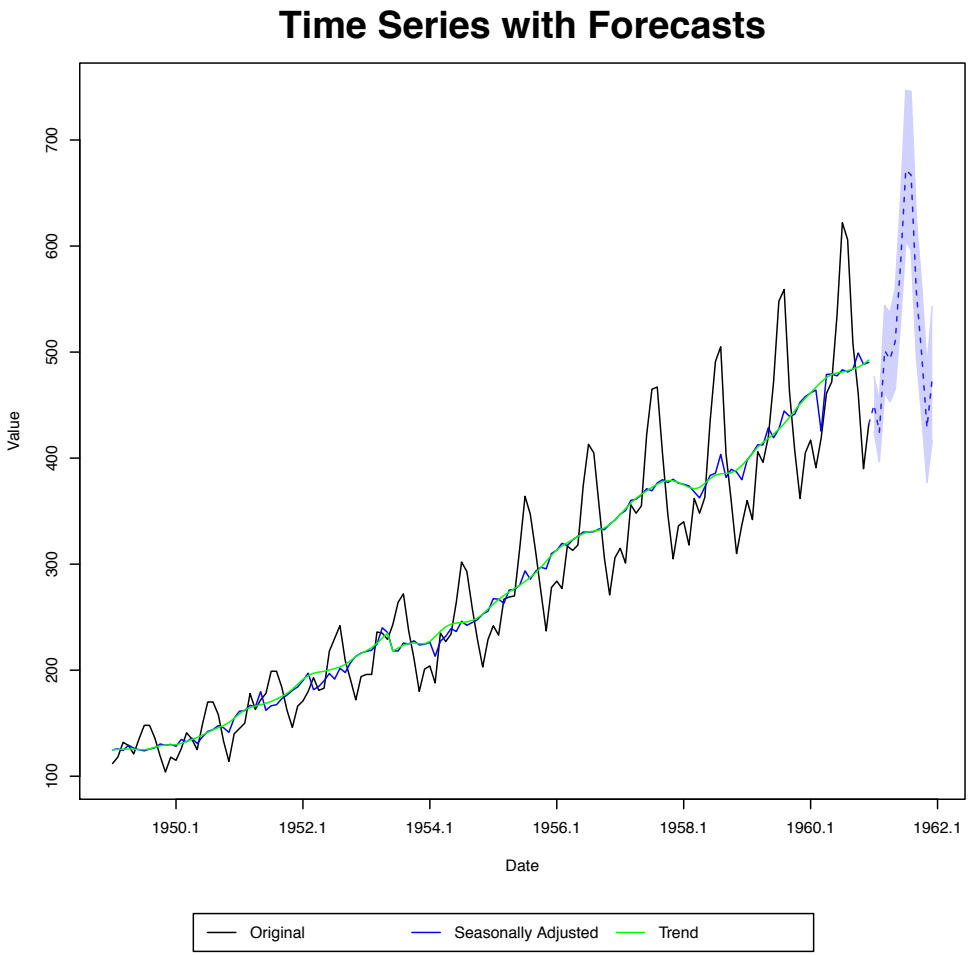
Real example Batch - Tourism

```
> plot(xb@x12List[[1]], forecast = TRUE,
+    span = c(2008,4,2018,4), ylab = "Nights spend")
```



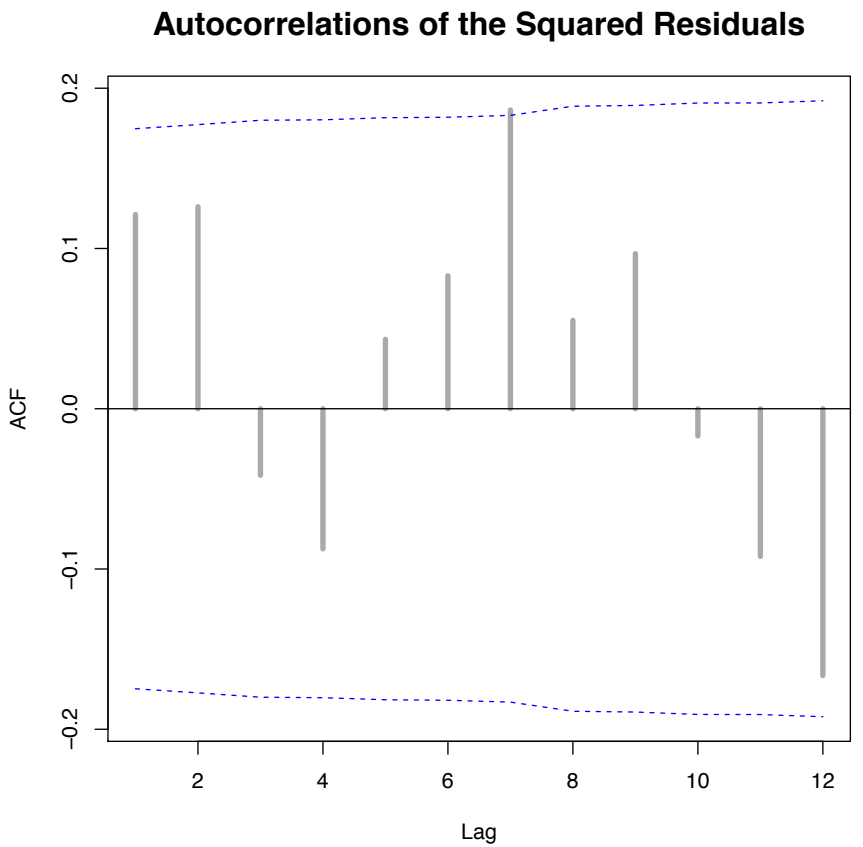
Plot functions I

- Output of the `plot()` method showing trend and forecasts with prediction intervals as well as the seasonally adjusted series.



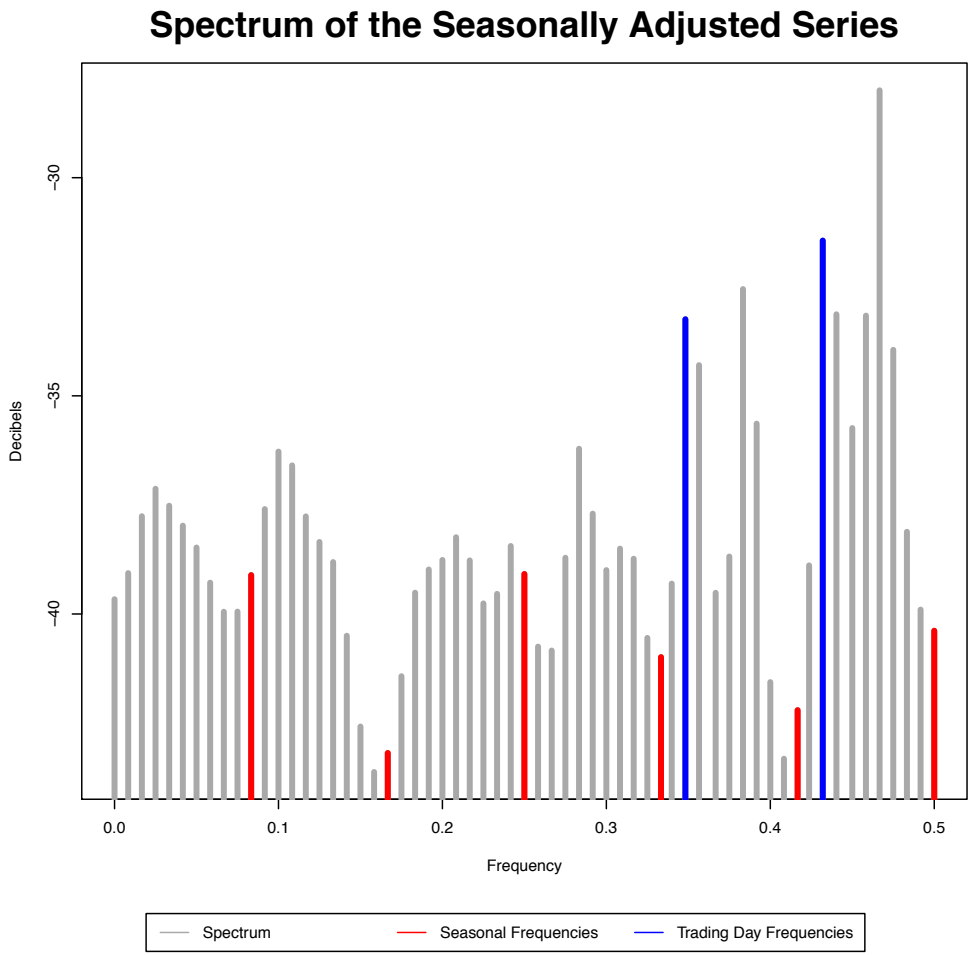
Plot functions II

- Output of the `plotRsdAcf()` function from the R package `x12`, showing the autocorrelations of the squared residuals from the regARIMA model.



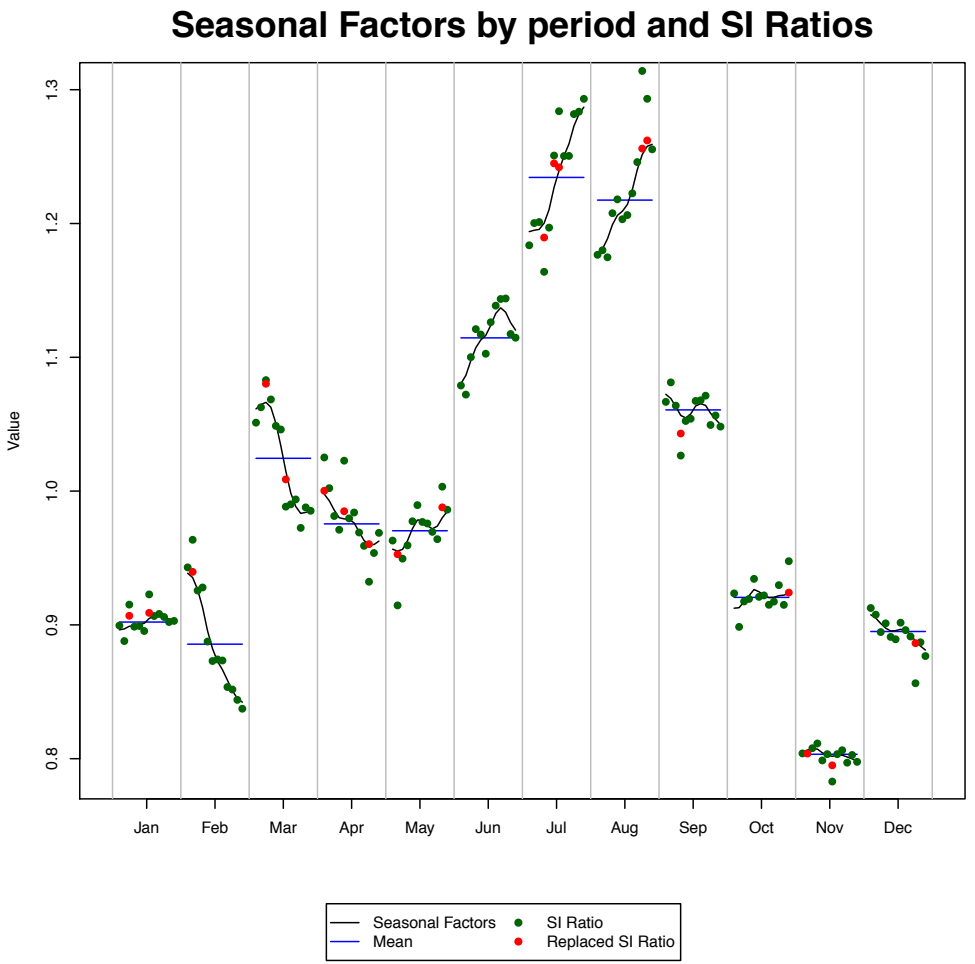
Plot functions III

- Output of the `plotSpec()` function, showing the spectrum of the seasonally adjusted series.



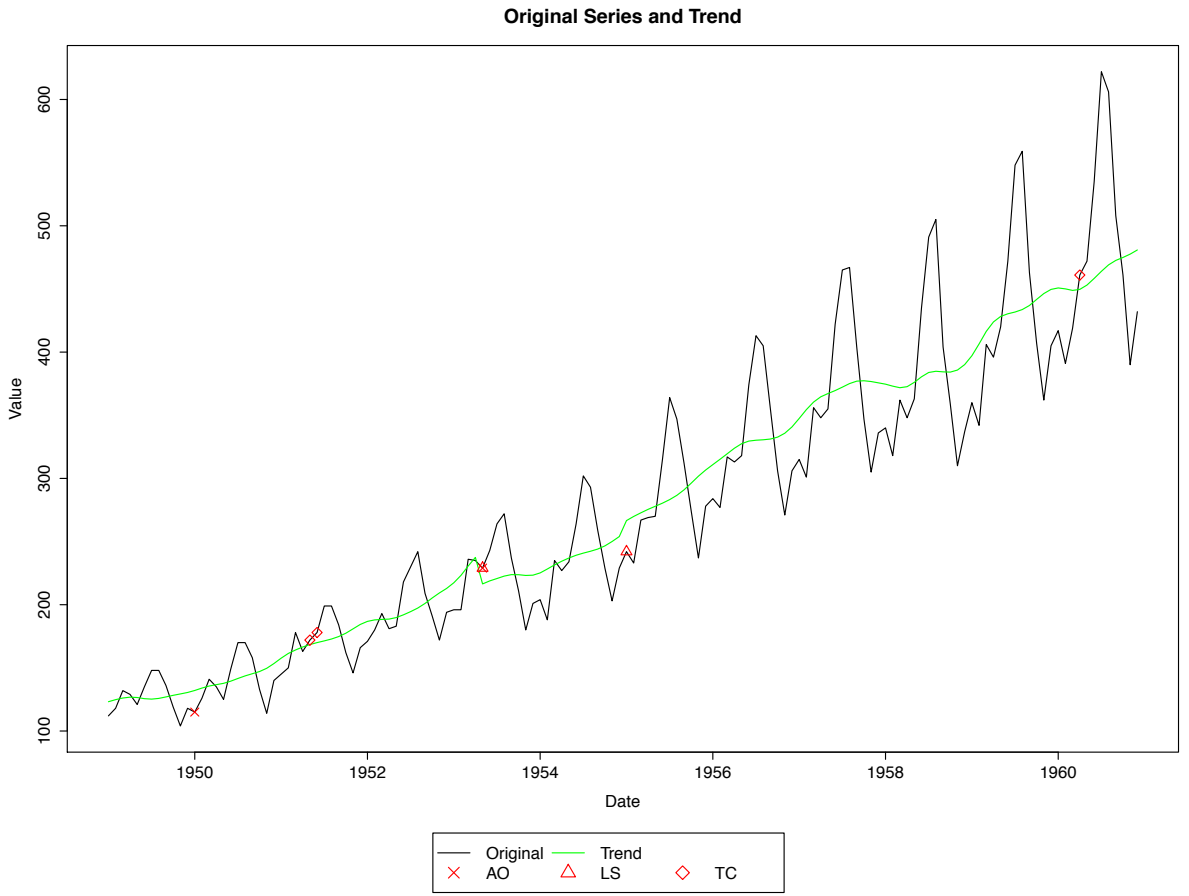
Plot functions IV

- Output of the seasonal factor plot (`plotSeasFac()`).



Plot functions V

- Output of the `plot()` method showing outliers in the RegARIMA model.



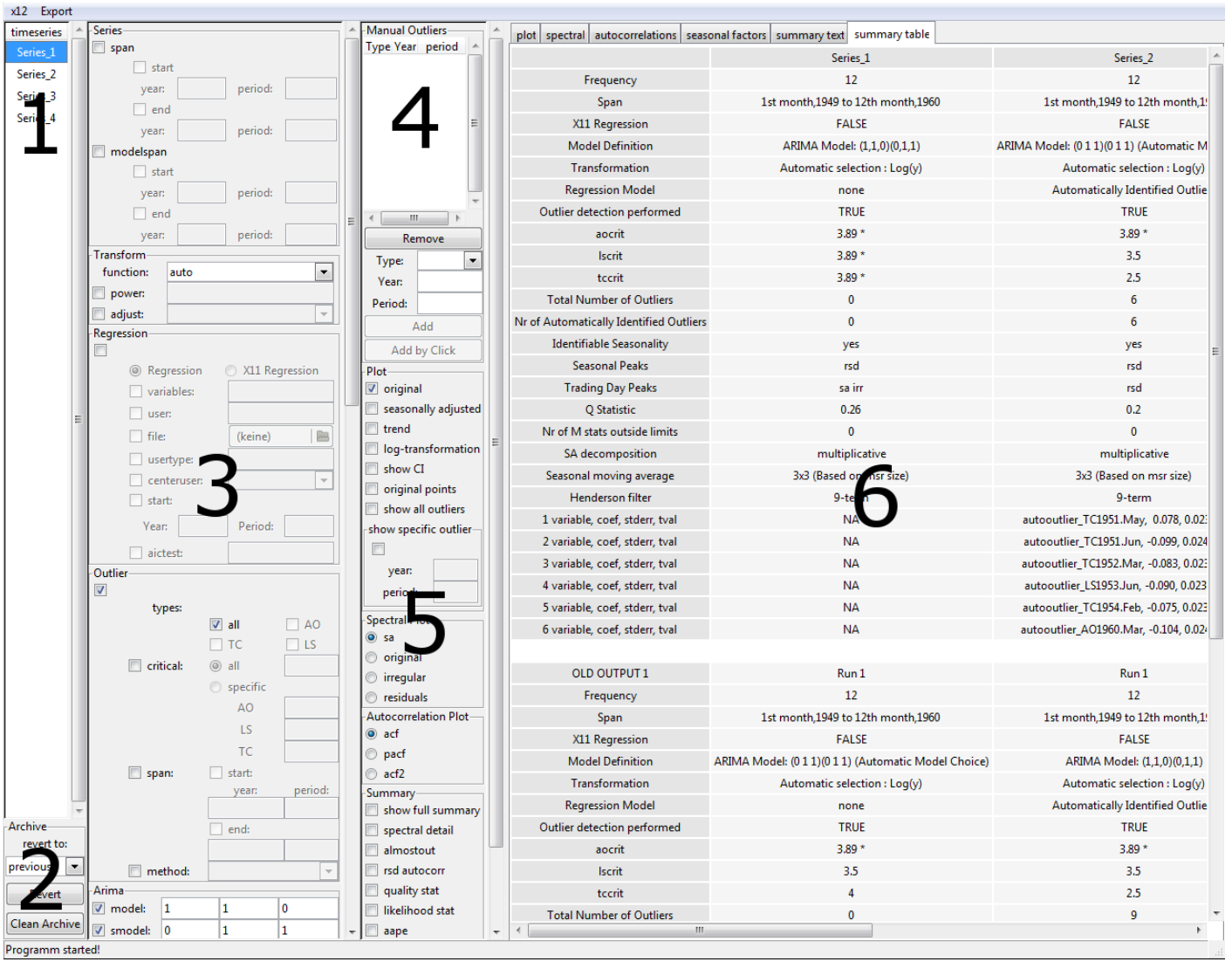
Features x12GUI

- Overview of all (implemented) X12-ARIMA parameters
- Interactive adjustment of the parameters
- Interactive graphics
- Visualisation of the automatically detected outliers
- Easy addition, removal of manually selected outliers

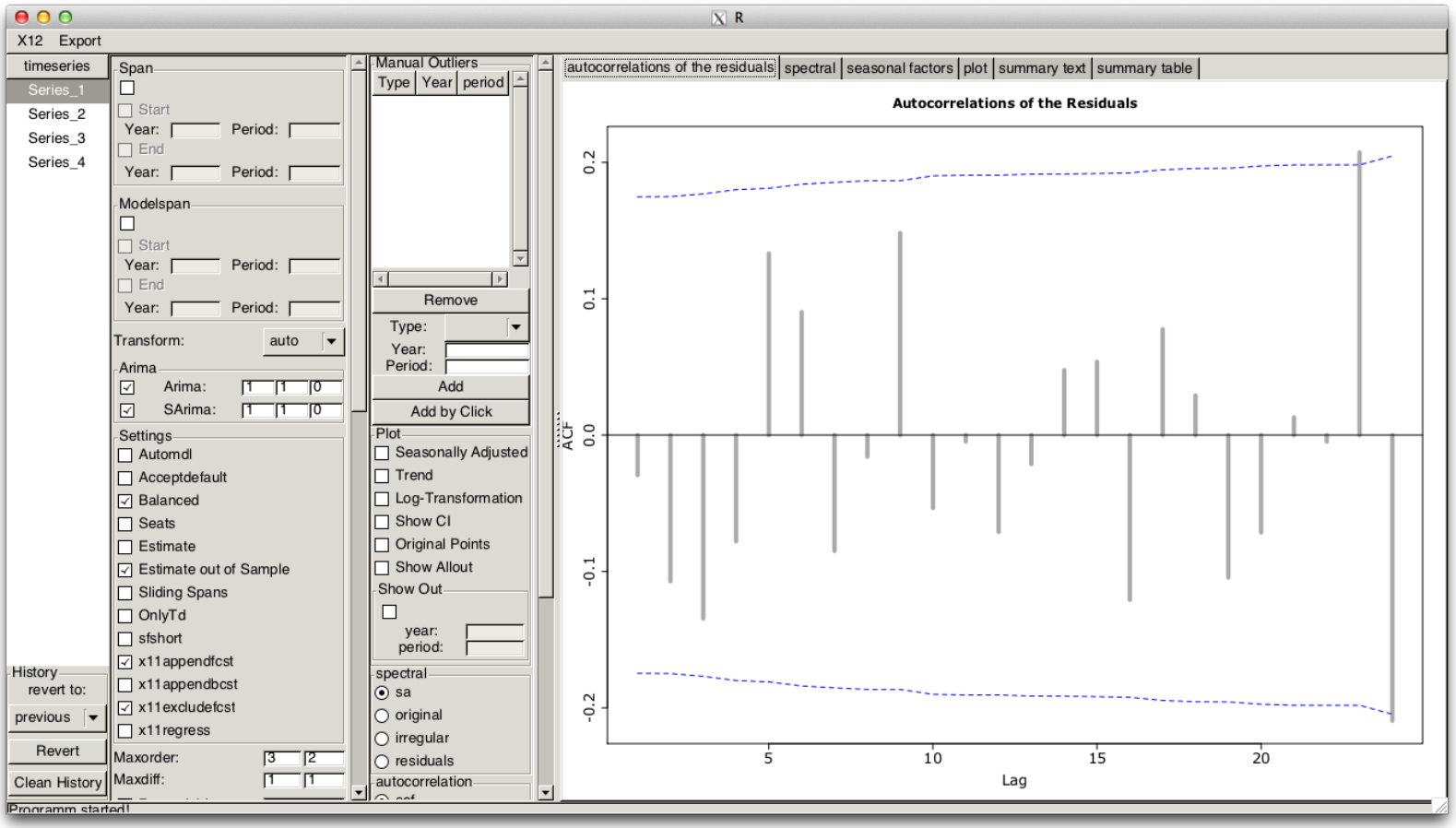
Main View x12GUI

```
> xbn <- x12GUI(xb)
```

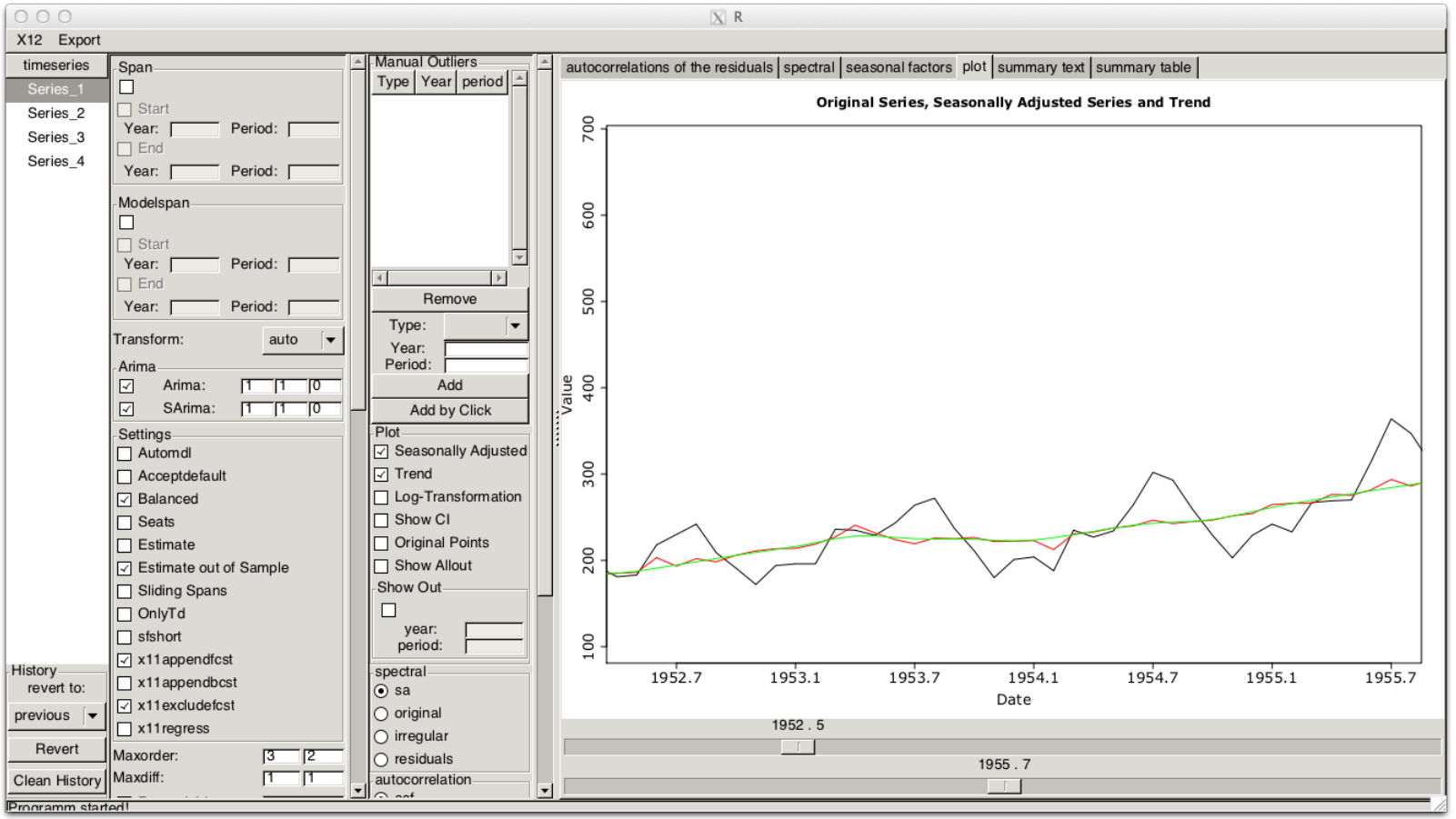
Main View x12GUI



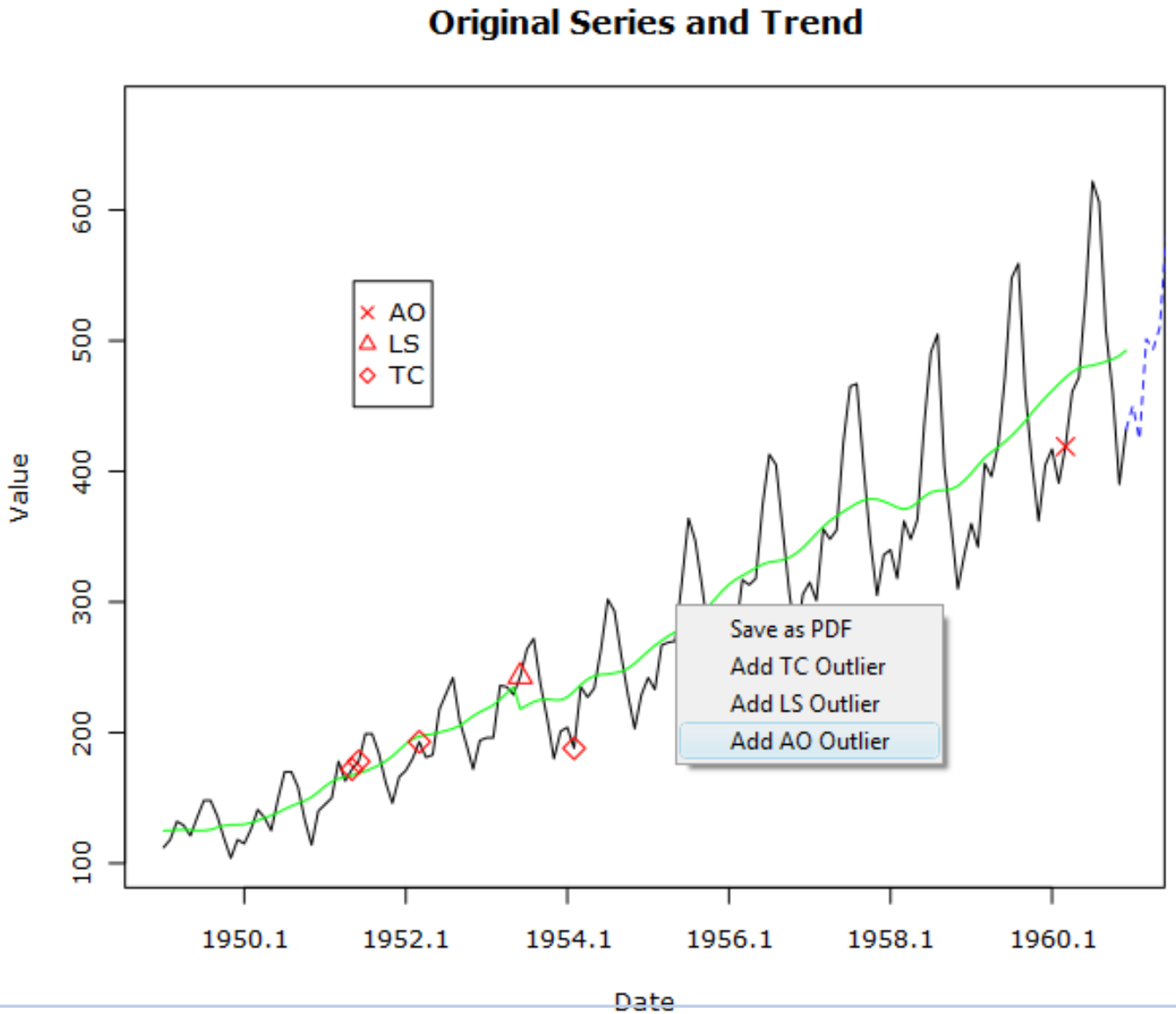
Graphics x12GUI



Interactive Plots x12GUI I



Interactive Plots x12GUI II



Details and contact

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- JSS paper "Seasonal Adjustment with the R packages x12 and x12GUI"

- Contact: Alexander Kowarik alexander.kowarik@statistik.gv.at
- https://github.com/alexkowa/x12