STATISTICS AUSTRIA
The Information Manager

Gregor de Cillia
Angelika Meraner
Statistics Austria

Toulouse, France
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Persephone

Hierarchical Time Series in R

Overview

- **persephone** builds on top of **RJDemetra**
- the focus lies on hierarchical time series
  - visualization (interactive plots)
  - diagnostics
- only available on GitHub.
  - still under development: interfaces might change
  - CRAN release is planned for this year

```
remotes::install_github("statistikat/persephone")
library(persephone)
```

Constructing Objects

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persephone objects can be constructed from time series

```
class(AirPassengers)
```

```
## [1] "ts"
```

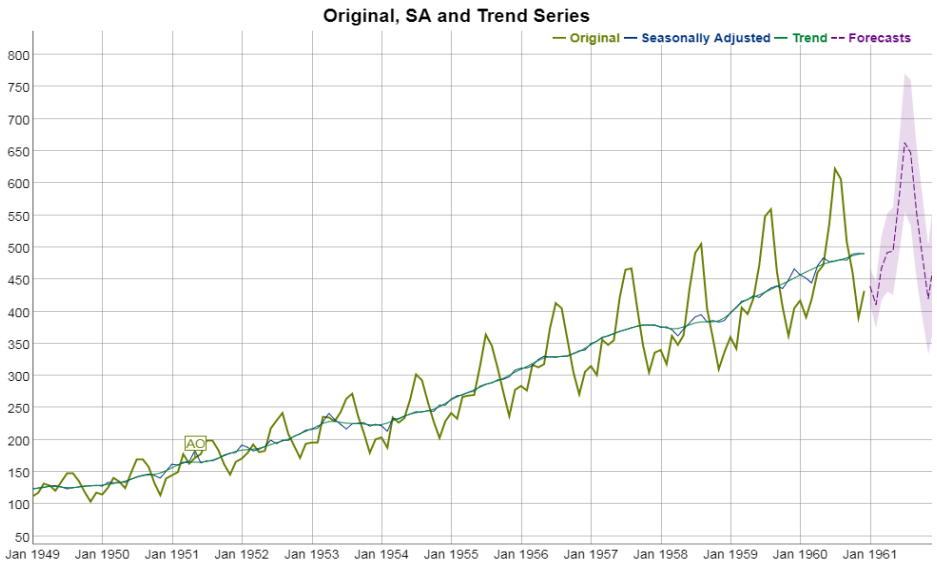
```
per_obj <- per_x13(AirPassengers)
```

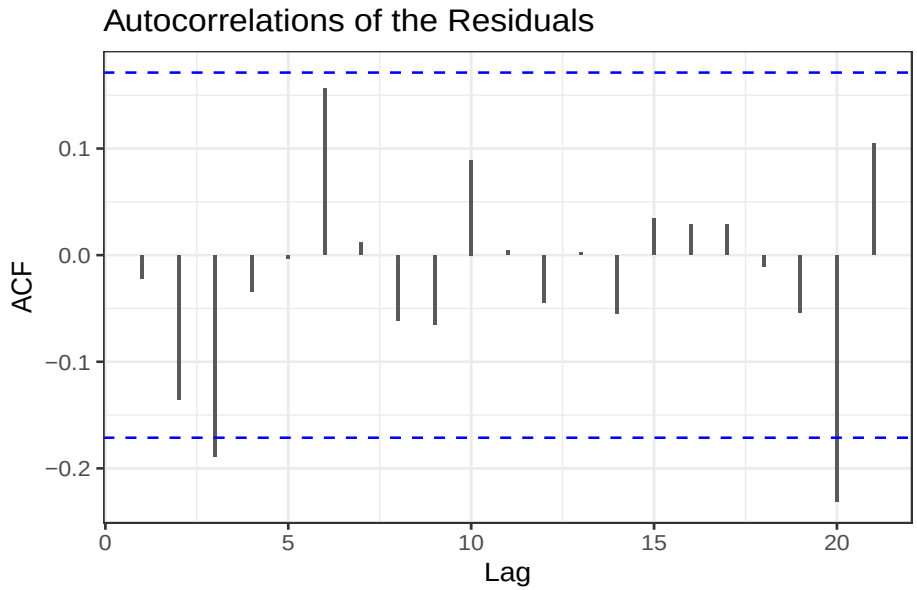
Now, different methods can be called for the object per_obj.

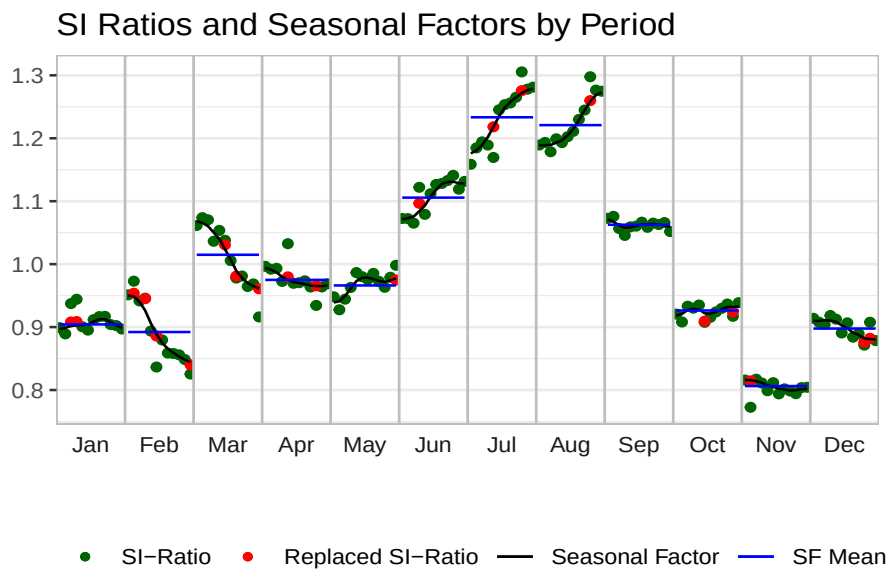
```
per_obj$run()
window(per_obj$adjusted, end = c(1950, 12))
```

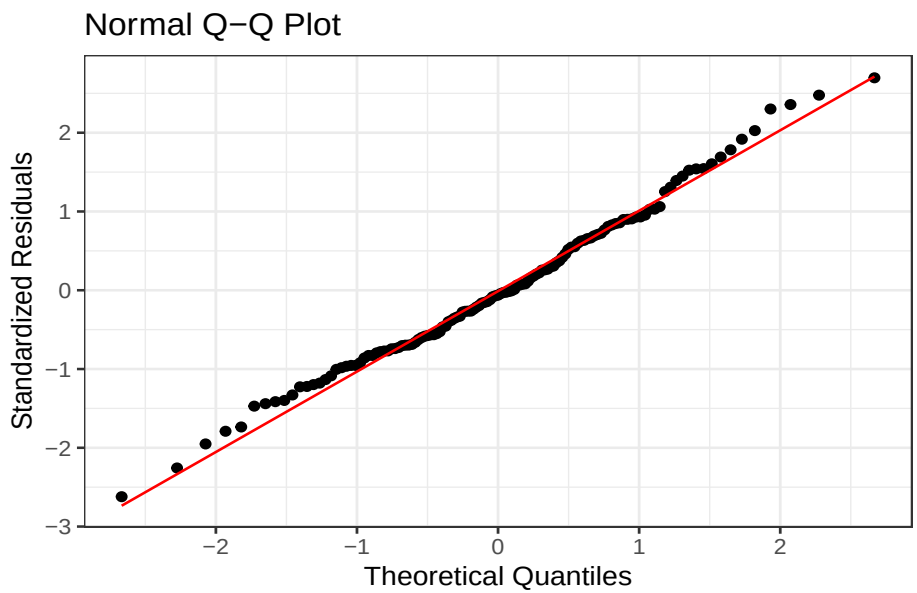
```
##              Jan       Feb       Mar       Apr       May       Jun
## 1949 123.7166 125.2532 125.9332 128.1540 129.0103 126.8570
## 1950 128.1056 133.9933 133.2078 134.0477 134.2078 138.9436
##              Jul       Aug       Sep       Oct       Nov       Dec
## 1949 123.9033 125.7702 127.0349 128.3796 128.5895 129.3838
## 1950 142.6304 145.0065 146.9006 144.5718 140.6555 151.4765
```

Plot Types


Original, SA and Trend Series
Original
Seasonally Adjusted
Trend
Forecasts
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
Jan 1949
Jan 1950
Jan 1951
Jan 1952
Jan 1953
Jan 1954
Jan 1955
Jan 1956
Jan 1957
Jan 1958
Jan 1959
Jan 1960
Jan 1961

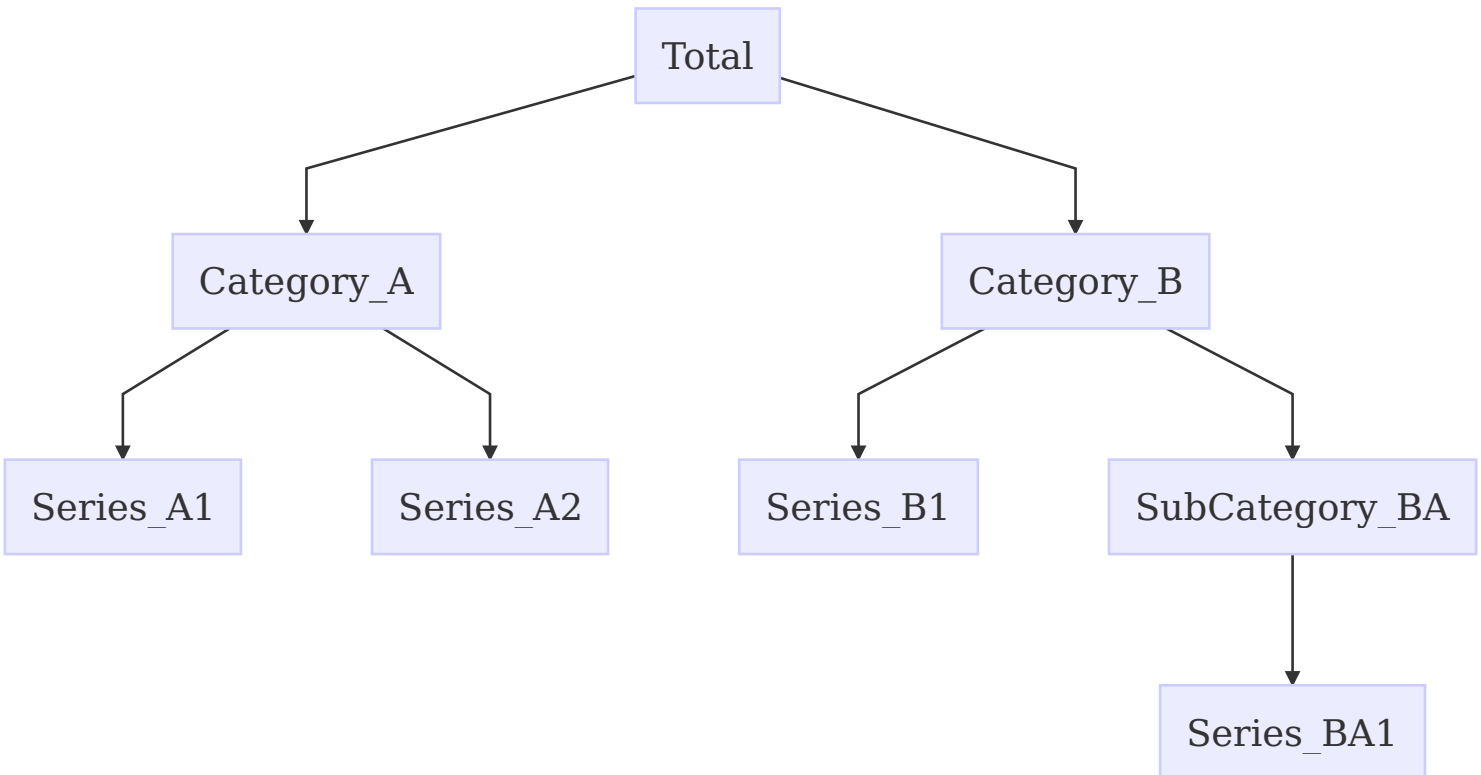

Autocorrelations of the Residuals
ACF
0.1
0.0
−0.1
−0.2
0
5
10
15
20
Lag


SI Ratios and Seasonal Factors by Period
1.3
1.2
1.1
1.0
0.9
0.8
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
SI−Ratio
Replaced SI−Ratio
Seasonal Factor
SF Mean


Normal Q−Q Plot
Standardized Residuals
2
1
0
−1
−2
−3
−2
−1
0
1
2
Theoretical Quantiles

Hierarchical Models

- hierarchical ts: time series that can be broken down into several components
- typical example: price indices
- tree-like structure



Hierarchical Models (2)

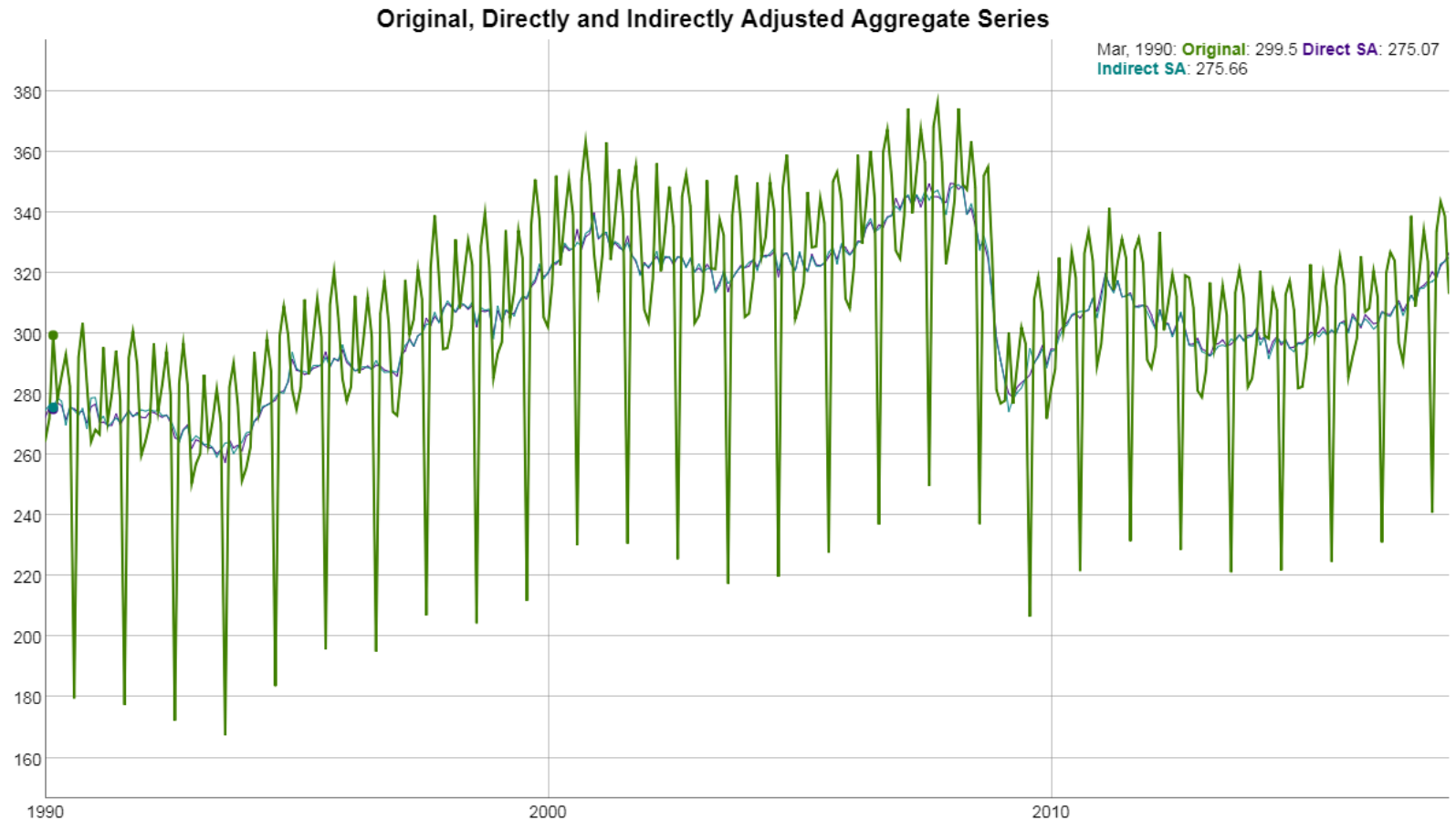
Several persephone objects can be combined to a hierarchical time series.

```
data(ipi_c_eu, package = "RJDemetra")
ht <- per_hts(
  NL = per_x13(ipi_c_eu[, "NL"]),
  FR = per_x13(ipi_c_eu[, "FR"]),
  IE = per_x13(ipi_c_eu[, "IT"])
)
ht$run(); ht
```

```
##   component class       run   seasonality log_transform
##             tramoseats TRUE  Present       TRUE
##   NL        x13Single  TRUE  Present      FALSE
##   FR        x13Single  TRUE  Present      FALSE
##   IE        x13Single  TRUE  Present      FALSE
##   arima_mdl       n_outliers q_stat
##   (3 1 1)(0 1 1) 1                  NA
##   (0 1 1)(0 1 1) 2           0.2644848
##   (0 1 1)(0 1 1) 3           0.2716330
##   (3 1 1)(0 1 1) 5           0.2251183
```

Hierarchical Plots

```
ht$run()
plot(ht)
```



Closing Remarks

Further plans:

- Eurostat quality report
- dashboards
- methods for comparing direct and indirect adjustments
- hierarchical time series with dynamic weights

More information (including this presentation) can be found on GitHub pages.

- https://statistikat.github.io/persephone/

Thank you for your attention!