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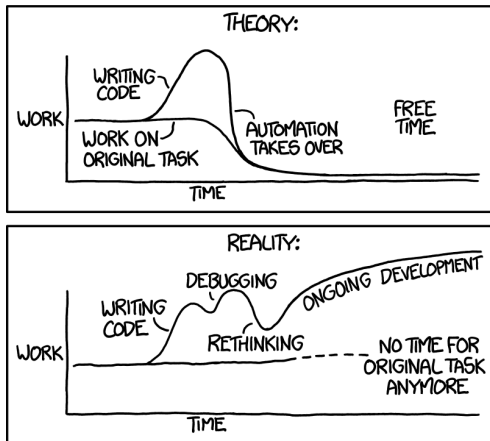
Wien  
Februrary 2021

# Persephone

Persephone, Production-Ready Seasonal  
Adjustment in R with RJDemetra

still under development. . .

"I SPEND A LOT OF TIME ON THIS TASK.  
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



Replace R-package x12 in production @ Statistics Austria for seasonal adjustment.

Requirements:

- Easy processing of multiple time series
- Support of hierarchical time series
- Weighted aggregate series
- R environment

→ Build wrapper around **RJDemetra** to fit our needs

- **persephone** provides SA-infrastructure for official statistics, i.e. dealing with multiple (hierarchical) monthly/quarterly time series
- Functions of **RJDemetra** performing SA are called in the background.
- Available on <https://github.com/statistikat/persephone>

1. 'Single' persephone objects are constructed with the functions `perX13()` or `perTramo()` depending on the choice of SA method (X-13-ARIMA-SEATS or TRAMO-SEATS).
2. 'Batch' persephone objects are constructed with the functions `perBatch()` as combination of single objects.
3. Multiple 'single' objects can be combined hierachically with `perHts()` to build a hierarchical persephone object.

## Example 1: Persephone Single Object

- Starting from a predefined JDemetra+ model specification has to be provided by the user, e.g. "RSA3"
- Updating parameters as needed

```
data(AirPassengers, package = "datasets")  
objX13 <- perX13(AirPassengers, "RSA3")  
objX13$updateParams(transform.function = "Log")
```

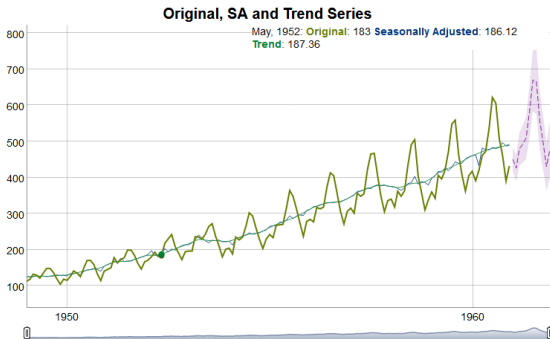
- Different methods can be called on the persephone objects

```
objX13$run()
```

## Example 1: Persephone Single Object

- Several plot methods have been implemented with the focus on using interactive tools, e.g. the default S3 generic `plot()` shows a zoomable line representation of the series.

```
plot(objX13)
```



- We generate a list of persephone single objects with x13 as method for all countries' time series.

```
ts_28 <- lapply(pi_caladj, perX13, template = "RSA3")
```

- We aggregate the Euro-area (EA-19) countries and set the method to be used for the direct adjustment of the aggregate series to x13 as well.

```
hts_EA19 <- perHts(list = ts_28[ea19], method = "x13")
```

- We then generate our final hierarchical persephone object `hts_EU28` which consists of the Euro-area countries as a hierarchical object and the remaining 9 countries as single objects.

```
non_ea19 <- eu28[which(!eu28 %in% ea19)]  
non_ea19
```

```
## [1] "BG" "CZ" "DK" "HR" "HU" "PL" "RO" "SE" "UK"
```

```
hts_EU28 <- perHts(list = c(EA19 = hts_EA19, ts_28[non_ea19]))
```

## Example 2: Persephone Hierarchical Object

- The structure of this object is represented in the `print` output. The “blank” component is the overall total.
- With a simple call to the `run()` method all subseries will be adjusted

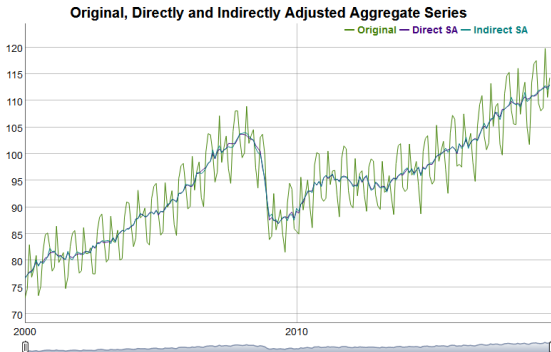
```
hts_EU28
```

```
## component run      class
##          FALSE hierarchicalTimeSeries
## EA19      FALSE hierarchicalTimeSeries
## EA19/BE   FALSE x13Single
## EA19/DE   FALSE x13Single
## EA19/EE   FALSE x13Single
## EA19/IE   FALSE x13Single
## EA19/EL   FALSE x13Single
## EA19/ES   FALSE x13Single
## EA19/FR   FALSE x13Single
## EA19/IT   FALSE x13Single
## EA19/CY   FALSE x13Single
## EA19/LT   FALSE x13Single
## EA19/LV   FALSE x13Single
## EA19/LU   FALSE x13Single
## EA19/MT   FALSE x13Single
## EA19/NL   FALSE x13Single
## EA19/AT   FALSE x13Single
## EA19/PT   FALSE x13Single
## EA19/SI   FALSE x13Single
## EA19/SK   FALSE x13Single
## EA19/FI   FALSE x13Single
## BG        FALSE x13Single
## CZ        FALSE x13Single
```

## Example 2: Persephone Hierarchical Object

- General comparison line chart called through the S3 generic `plot()` (only plot function for hierarchical persephone objects at the moment)

```
plot(hts_EU28)
```



## Example 2: Persephone Hierarchical Object

➤ Generate Eurostat quality report with the function `generateQrTable()`

```
head(generateQrTable(hts_EU28), n = 4)
```

```
## component Method Period Nobs Start End Log.Transformation ARIMA.Model
## 1 TS 12 233 1-2000 5-2019 TRUE (0 1 1)(0 1 1)
## 2 EA19 x13 12 233 1-2000 5-2019 FALSE (1 1 0)(0 1 1)
## 3 EA19/BE x13 12 233 1-2000 5-2019 FALSE (0 1 1)(0 1 1)
## 4 EA19/DE x13 12 233 1-2000 5-2019 TRUE (1 1 2)(0 1 1)
## LeapYear MovingHoliday NbTD Noutliers Outlier1 Outlier2 Outlier3
## 1 FALSE TRUE 6 4 LS (11-2008) LS (12-2008) LS (1-2009)
## 2 TRUE TRUE 7 2 LS (11-2008) TC (11-2008) <NA>
## 3 FALSE FALSE 0 2 LS (11-2008) AO (5-2009) <NA>
## 4 FALSE FALSE 0 2 LS (1-2009) LS (11-2008) <NA>
## CombinedTest_SI Residual.Seasonality Residual.TD.Effect Q.Stat
## 1 Present No No NA
## 2 Present No 0.16
## 3 Present No Yes 0.35
## 4 Present No Yes 0.22
## Final.Henderson.Filter Stage.2.Henderson.Filter Seasonal.Filter Max.Adj
## 1 <NA> <NA> <NA> 14%
## 2 H13 H13 3x5 19%
## 3 H13 H13 3x5 14%
## 4 H13 H13 3x5 9%
```

- Persephone Batch Object `perBatch()`
- `fixModel()` or `fixOutlier()`s (except for a timespan at the end of the series)

```
objX13$fixModel(verbose=TRUE)
```

```
## The model( 0 1 1 ) ( 0 1 1 ) is now fixed.
```

```
objX13$fixOutlier(verbose=TRUE)
```

```
## No automatic outliers found.
```

```
## Updating parameter outlier.from to '1960-01-01'
```

```
td7 <- genTd(freq = 4, hd = list("01-01", "01-06",  
                                "easter+1", "easter+39"),  
            weight = c(rep(1,11), 0.5, rep(1,2), 0.5))
```

- Benchmark method for direct adjustments
- Indirect adjustment of chain-linked indices
- Summary method
- Dashboard for large numbers of time series

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