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RJDemetra: an R interface to JDemetra+

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Purpose of the RJDemetra package

- Complete R package for Tramo-Seats and X13
- Users: "pure R" package
  - Part of R routines, automatization
    - Batch processing
    - E.g.: direct vs indirect aggregates adjustment, dashboards
  - Usage of other R functions and packages
- JD+ functionality
  - Modeling and seasonal adjustment
  - Full specification
- Advanced graphical presentation: JD+

Current status

- RegARIMA, TRAMO-SEATS and X-13-ARIMA:
  - R package with documentation
  - S3 classes with plot, summary, print methods
  - Possibility to add user-defined regressors but not user-defined calendar regressors
- Manipulate workspace (only TRAMO-SEATS and X-13-ARIMA):
  - Import JD+ workspace to get: input raw series or SA model
  - Export R models created via RJDemetra

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RegARIMA examples (1/4)

```
library(RJDemetra);options(enable_print_style = FALSE)
myseries <- ipi_c_eu[,"FR"]
regarima_model <- regarima_def_x13(myseries, spec = "RG4c")
str(regarima_model, max.level = 1)
```

```
## List of 9
##  $ specification          :List of 7
##  $ arma                   : Named num [1:6] 2 1 1 0 1 1
##   ..- attr(*, "names")= chr [1:6] "p" "d" "q" "bp" ...
##  $ arima.coefficients     : num [1:4, 1:3] 0.336 0.206 -0.245 -0.511 0.171 ..
##   ..- attr(*, "dimnames")=List of 2
##  $ regression.coefficients: num [1:4, 1:3] -1.133 -8 -7.551 -5.069 0.337 ...
##   ..- attr(*, "dimnames")=List of 2
##  $ loglik                 : num [1:7, 1] -631 9 323 1280 1281 ...
##   ..- attr(*, "dimnames")=List of 2
##  $ model                  :List of 2
##  $ residuals              : Time-Series [1:323] from 1991 to 2018: -2.601 0.5
##  $ residuals.stat         :List of 2
##  $ forecast               : Time-Series [1:24, 1:2] from 2018 to 2020: 102 10
##   ..- attr(*, "dimnames")=List of 2
##  - attr(*, "class")= chr [1:2] "regarima" "X13"
```

RegARIMA examples (2/4)

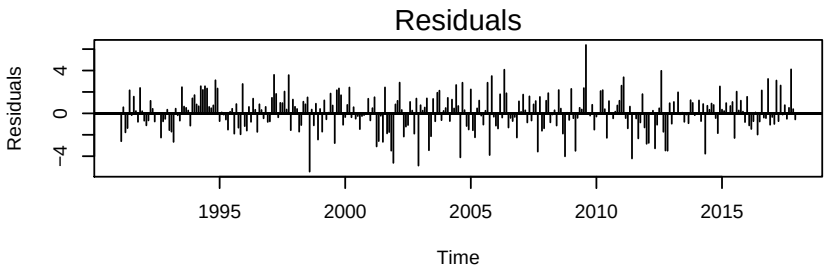
Console | Terminal | R Markdown

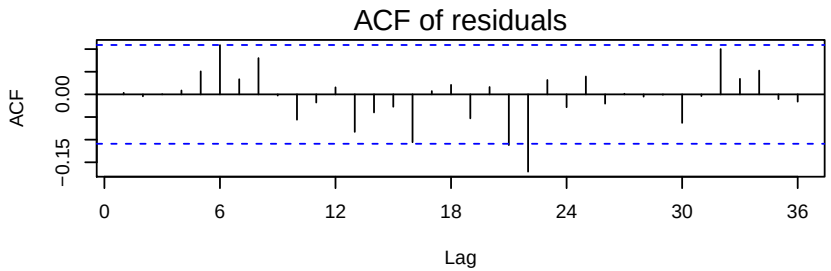
~/NTTS/

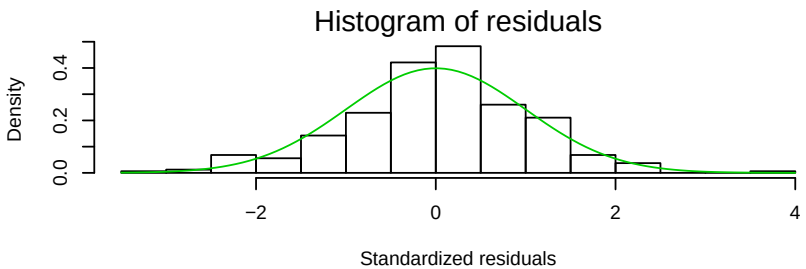
```
> regarima_model
y = regression model + arima (2, 1, 1, 0, 1, 1)
Log-transformation: no
Coefficients:
          Estimate Std. Error
Phi(1)      0.3358      0.171
Phi(2)      0.2060      0.096
Theta(1)   -0.2450      0.173
BTheta(1)  -0.5112      0.050

             Estimate Std. Error
Easter [1]     -1.133      0.337
LS (11-2008)   -8.000      1.283
LS (1-2009)    -7.551      1.283
LS (5-2008)    -5.069      1.234


Residual standard error: 1.696 on 323 degrees of freedom
Log likelihood =  -631, aic =  1280 aicc =  1281, bic(corrected for length) =   1.2

>
```

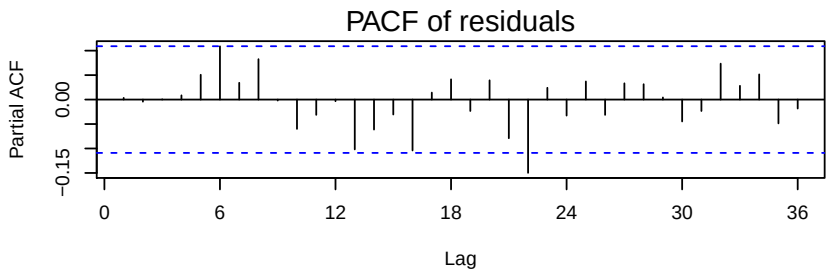
RegARIMA examples (3/4)

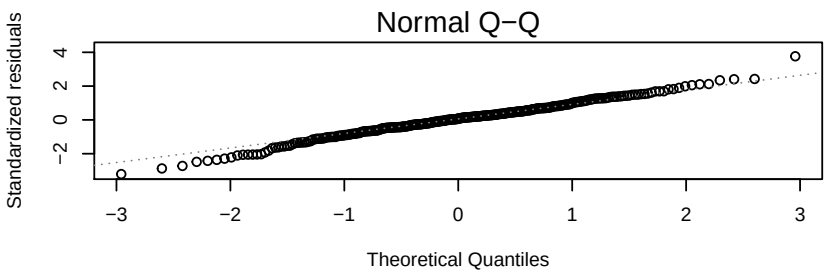
```
layout(matrix(1:6, 3, 2));plot(regarima_model, ask = FALSE)
```

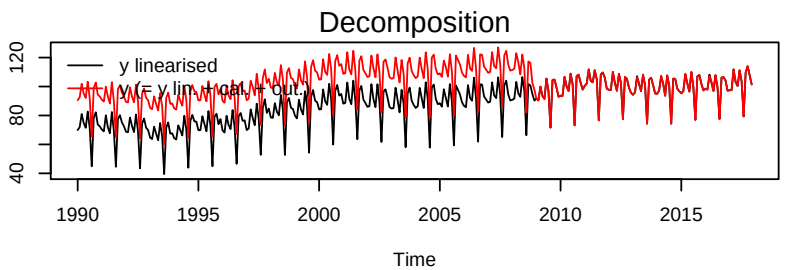






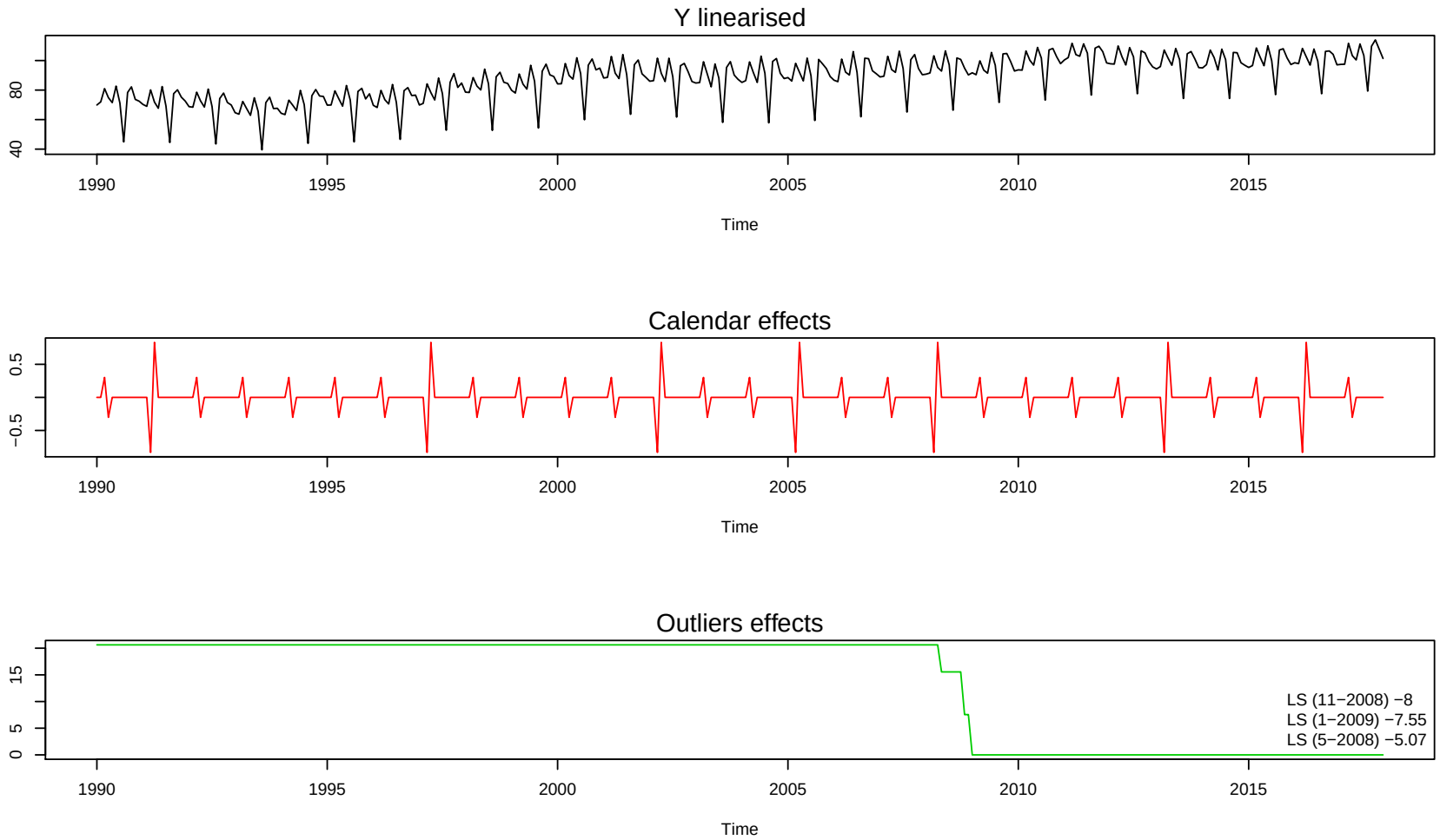






RegARIMA examples (3/4): extra plot

```
plot(regarima_model, which = 7, dec_zoom = TRUE)
```



Seasonal adjustment examples (1/7)

A `SA` object is a `list()` of 5 elements:

1. `regarima`: the RegArima model
2. `decomposition`: decomposition variables ($\neq$ for TRAMO-SEATS and X-13-ARIMA)
3. `final`: time series main results
4. `diagnostics`: residuals tests, etc.
5. `user_defined`: other user_defined variables not exported by default (see `?user_defined_variables`)

```
x13_usr_spec <- x13_spec_def(spec=c("RSA5c"),usrdef.outliersEnabled = TRUE,
                             usrdef.outliersType = c("LS","AO"),
                             usrdef.outliersDate=c("2008-10-01","2002-01-01"),
                             usrdef.outliersCoef = c(36000,14000),
                             transform.function = "None")
x13_mod <- x13(myseries, x13_usr_spec)
ts_mod <- tramoseats_def(myseries, spec = "RSAfull")
```

Seasonal adjustment examples (2/7)

```
x13_mod$decomposition
```

```
##  Monitoring and Quality Assessment Statistics:
##        M stats
## M(1)     0.061
## M(2)     0.000
## M(3)     0.960
## M(4)     0.621
## M(5)     0.725
## M(6)     0.244
## M(7)     0.075
## M(8)     0.216
## M(9)     0.055
## M(10)    0.175
## M(11)    0.160
## Q        0.302
## Q-M2     0.339
##
## Final filters:
## Seasonal filter:  3x5
## Trend filter:  13 terms Henderson moving average
```

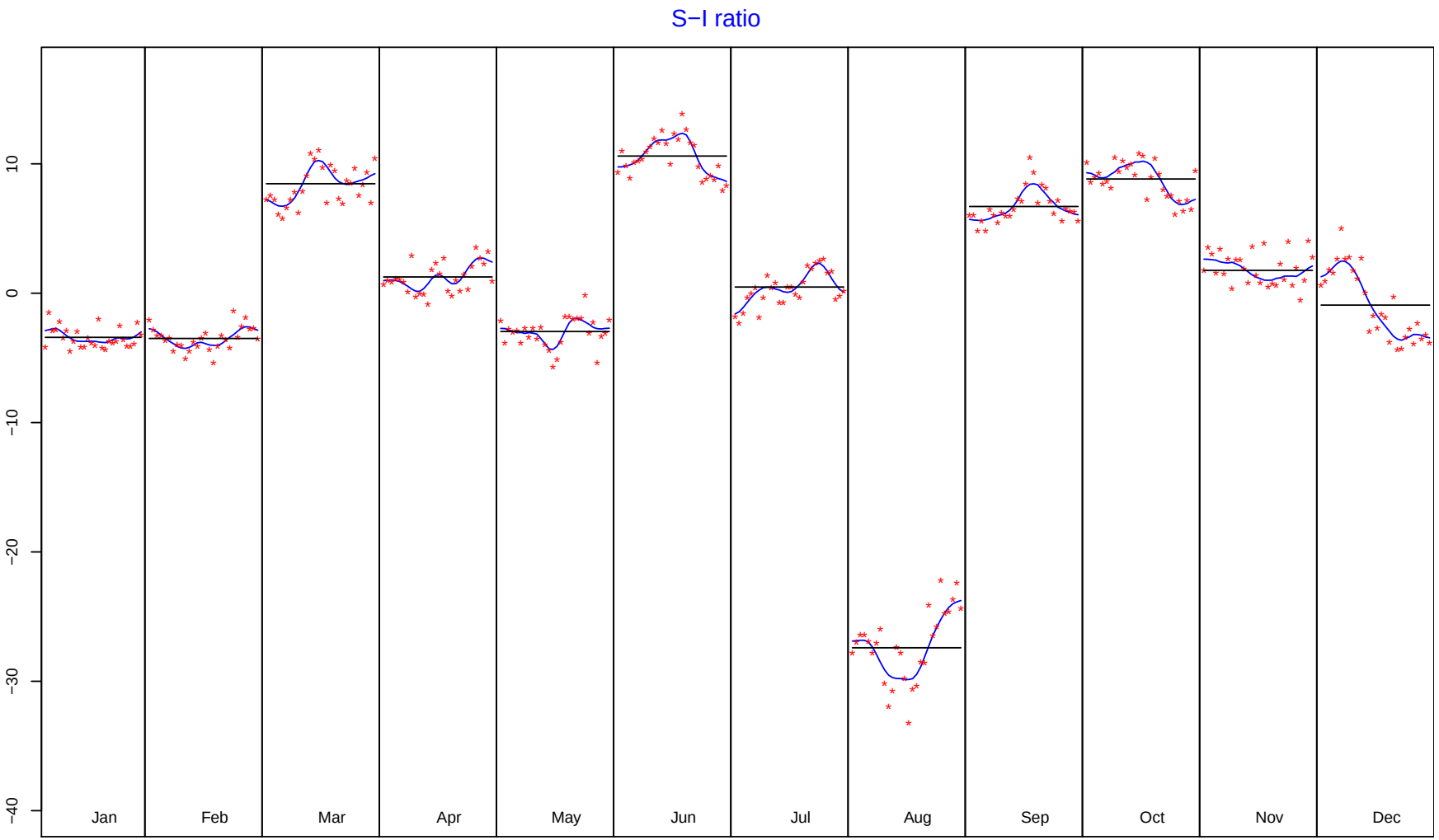
Seasonal adjustment examples (3/7)

```
ts_mod$decomposition
```

```
## Model
## AR :  1 + 0.352498 B + 0.133616 B^2
## D :  1 - B - B^12 + B^13
## MA :  1 - 0.186819 B - 0.610856 B^12 + 0.114119 B^13
##
##
## SA
## D :  1 - 2.000000 B + B^2
## MA :  1 - 1.314459 B + 0.340427 B^2
## Innovation variance:  0.4669153
##
## Trend
## D :  1 - 2.000000 B + B^2
## MA :  1 + 0.040206 B - 0.959794 B^2
## Innovation variance:  0.04869563
##
## Seasonal
## AR :  1 + 0.352498 B + 0.133616 B^2
## D :  1 + B + B^2 + B^3 + B^4 + B^5 + B^6 + B^7 + B^8 + B^9 + B^10 + B^11
## MA :  1 + 0.717848 B + 0.460721 B^2 + 0.310085 B^3 + 0.132447 B^4 - 0.049053
## Innovation variance:  0.1601924
```

Seasonal adjustment examples (4/7)

```
plot(x13_mod$decomposition)
```



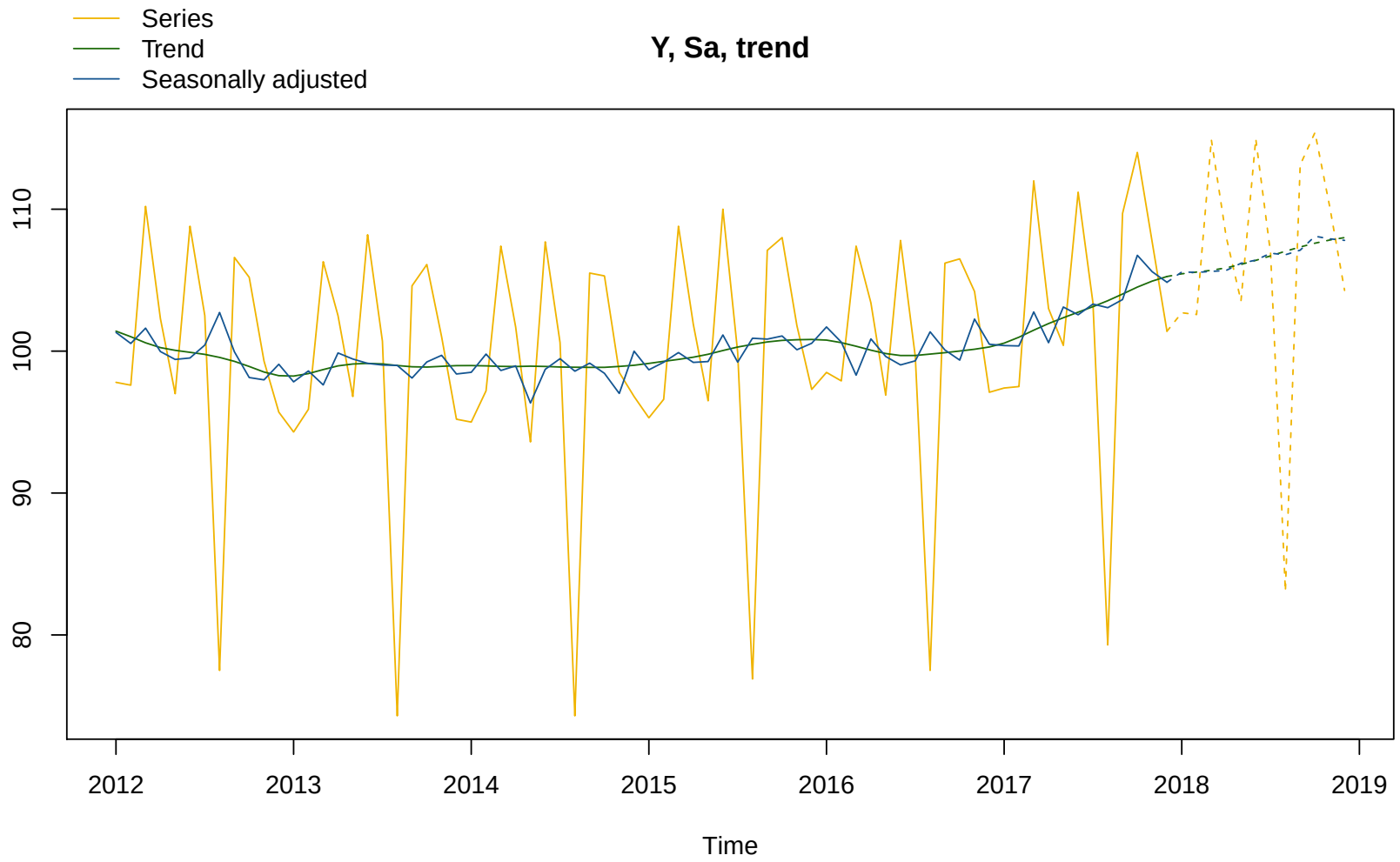
Seasonal adjustment examples (5/7)

```
x13_mod$final
```

```
## Last observed values
##                y       sa        t             s          i
## Jan 2017  97.4 100.3902 100.5631  -2.99019403 -0.1729099
## Feb 2017  97.5 100.3646 100.9790  -2.86460513 -0.6143814
## Mar 2017 112.0 102.7607 101.4754   9.23928088  1.2852852
## Apr 2017 103.0 100.5925 101.9417   2.40747193 -1.3491871
## May 2017 100.4 103.1054 102.3511  -2.70539979  0.7542873
## Jun 2017 111.2 102.5591 102.7440   8.64087923 -0.1848857
## Jul 2017 103.4 103.3144 103.1308   0.08560672  0.1835989
## Aug 2017  79.3 103.0602 103.5499 -23.76018864 -0.4897563
## Sep 2017 109.7 103.6331 104.0215   6.06692870 -0.3884680
## Oct 2017 114.0 106.7526 104.5113   7.24741395  2.2412439
## Nov 2017 107.7 105.5963 104.9317   2.10371268  0.6645400
## Dec 2017 101.4 104.8511 105.2567  -3.45110589 -0.4056223
##
## Forecasts:
##                  y_f     sa_f      t_f           s_f          i_f
## Jan 2018 102.70258 105.5740 105.4465  -2.87143758  0.12749286
## Feb 2018 102.57727 105.5466 105.5700  -2.96928512 -0.02343246
## Mar 2018 114.89223 105.6137 105.6941   9.27854825 -0.08039957
## Apr 2018 108.05979 105.6858 105.8691   2.37398629 -0.18326092
```

Seasonal adjustment examples (6/7)

```
plot(x13_mod$final, first_date = 2012, type_chart = "sa-trend")
```



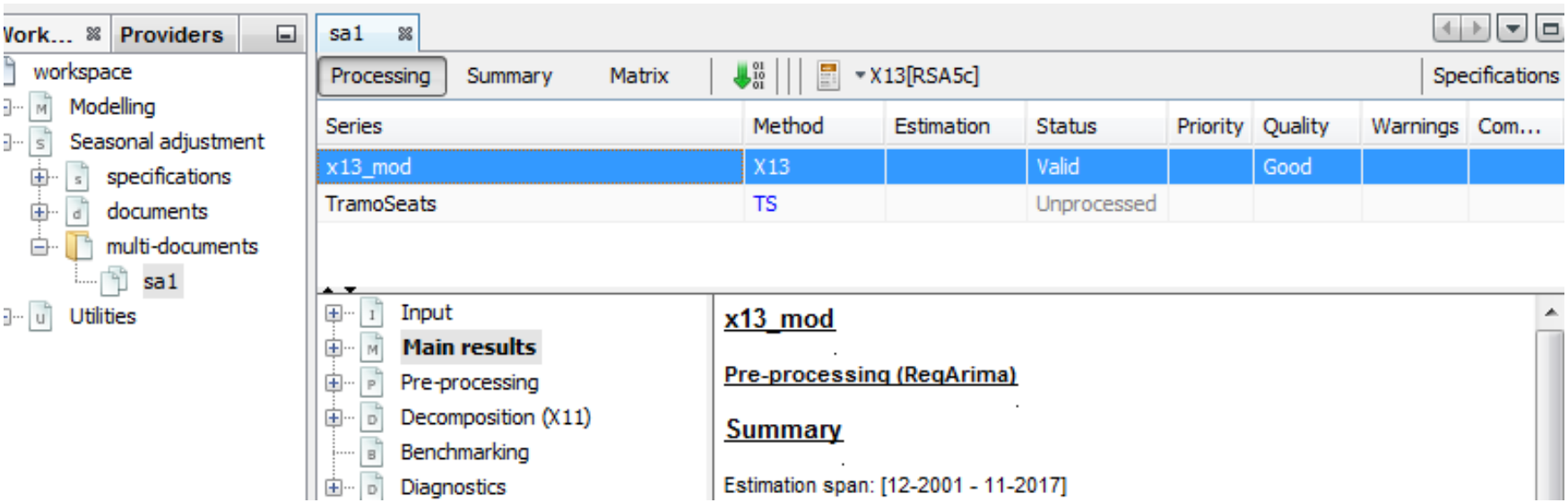
Seasonal adjustment examples (7/7)

```
x13_mod$diagnostics
```

```
##  Relative contribution of the components to the stationary
##  portion of the variance in the original series,
##  after the removal of the long term trend
##  Trend computed by Hodrick-Prescott filter (cycle length = 8.0 years)
##             Component
##  Cycle          1.656
##  Seasonal      39.710
##  Irregular      0.369
##  TD & Hol.      0.000
##  Others        61.757
##  Total        103.492
##
##  Combined test in the entire series
##  Non parametric tests for stable seasonality
##                                                                 P.value
##    Kruskall-Wallis test                                           0.000
##    Test for the presence of seasonality assuming stability        0.000
##    Evolutive seasonality test                                     0.024
##
##  Identifiable seasonality present
##
```

Export a workspace

```
wk <- new_workspace()
new_multiprocessing(wk, name = "MP-1")
add_sa_item(wk, multiprocessing = "MP-1",
            sa_obj = x13_mod, name =  "SA with X13 model 1 ")
add_sa_item(wk, multiprocessing =  "MP-1",
            sa_obj = ts_mod, name = "SA with TramoSeats model 1")
save_workspace(wk, "workspace.xml")
```

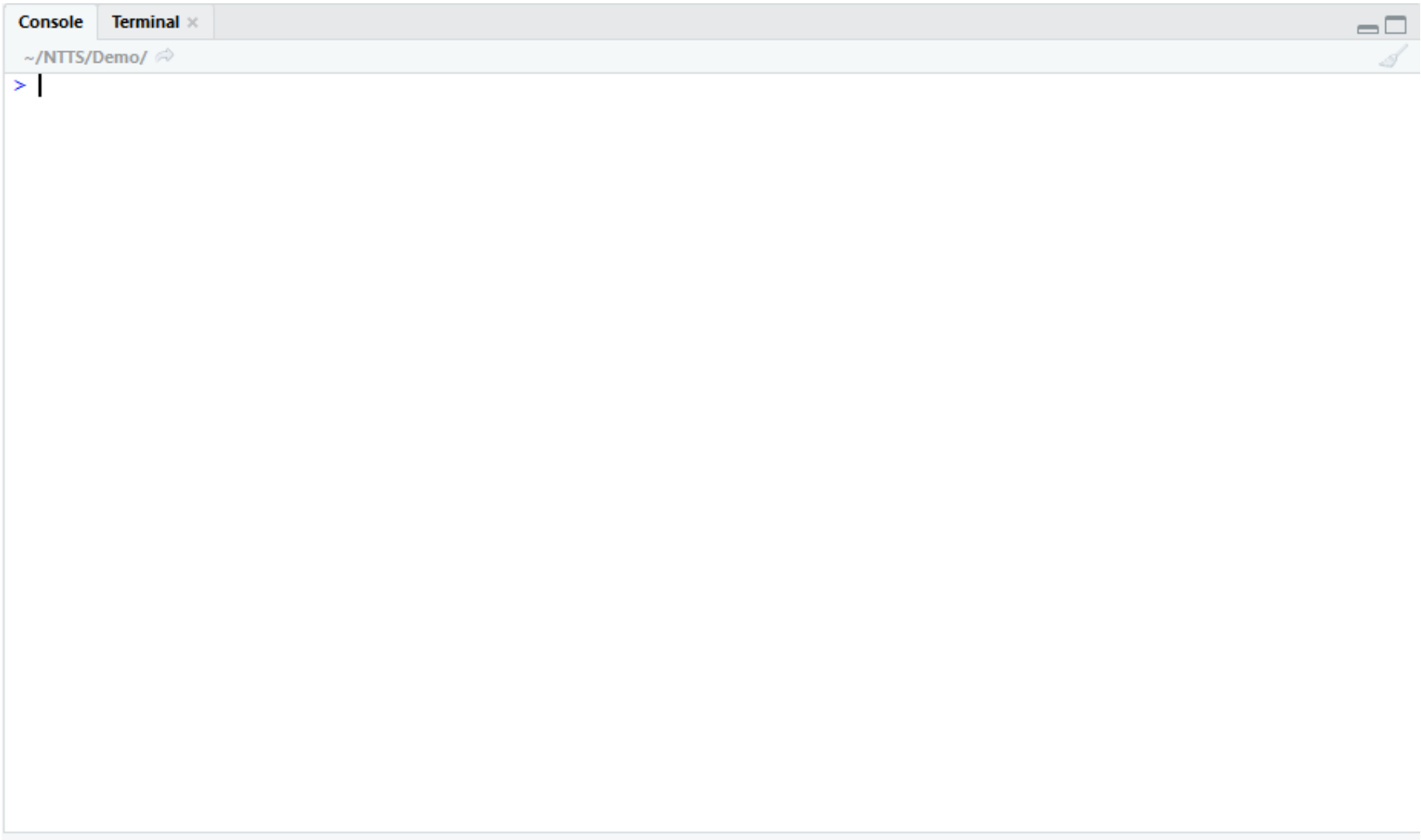


Import a workspace (1/3)

```
wk <- load_workspace("workspace.xml")
get_ts(wk)
```

```
## $`MP-1`
## $`MP-1`$`SA with X13 model 1 `
##         Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov
## 1990  90.5  92.6 101.9  95.2  92.1 103.3  91.8  65.5  99.0 102.8  94.3
## 1991  90.9  89.6  99.9  93.3  88.3 103.0  89.7  65.1  98.2 100.8  95.8
## 1992  89.4  89.0  99.5  93.0  89.1 101.3  89.4  64.1  94.9  98.6  92.2
## 1993  85.3  84.3  93.2  87.8  83.5  95.4  86.2  60.1  92.1  95.8  88.1
## 1994  84.9  84.0  94.1  90.1  86.8 100.4  90.8  64.5  96.8 101.0  96.6
## 1995  90.4  90.5 100.4  94.5  89.7 103.7  93.8  65.5  99.7 101.8  94.6
## 1996  90.3  88.8 100.7  93.8  91.2 104.4  92.3  67.2 100.2 102.3  96.9
## 1997  90.5  91.6 104.0  99.7  93.9 108.8  98.2  73.4 105.8 111.8 102.4
## 1998  99.2  99.0 109.4 103.0 100.7 114.8 104.9  73.3 109.6 112.7 105.9
## 1999 100.5  98.6 111.8 104.3 101.3 117.4 106.6  74.9 113.4 118.2 110.9
## 2000 104.8 104.9 118.9 110.2 108.0 122.5 111.8  80.5 117.5 121.7 114.3
## 2001 108.8 109.2 123.7 111.8 108.4 124.7 111.1  84.2 117.8 121.0 111.6
## 2002 106.6 107.0 121.4 112.8 106.4 122.2 109.7  82.3 117.1 118.7 113.0
## 2003 105.4 105.7 120.1 111.1 102.8 118.3 108.8  78.7 115.9 119.9 110.8
## 2004 105.8 107.0 120.0 112.1 105.8 123.6 112.0  78.4 120.0 122.0 112.0
## 2005 109.1 106.7 117.9 113.5 106.8 122.3 110.3  80.0 121.4 118.4 115.2
## 2006 107.3 106.3 121.9 112.5 110.8 126.7 112.5  82.5 122.2 121.9 113.7
```

Import a workspace (2/3)



Import a workspace (3/3)

```
compute(wk) # Important to get the Sa model
models <- get_model(wk) # A progress bar is printed by default
```

```
## Multiprocessing 1 on 1:
##
  |
  |                                                                      |   0%
  |
  |================================                                      |  50%
  |
  |======================================================================| 100%
```

```
# To extract only one model
mp <- get_object(wk, 1)
count(mp)
```

```
## [1] 2
```

```
sa2 <- get_object(mp,2)
get_name(sa2)
```

```
## [1] "SA with TramoSeats model 1"
```

```
mod <- get_model(wk, sa2)
```

How to install the package?

The package is available on GitHub: https://github.com/jdemetra/rjdemetra

It has also it's own website: https://jdemetra.github.io/rjdemetra/

It package can be installed from CRAN:

```
install.packages("RJDemetra")
```

Or from github (development version):

```
devtools::install_github("jdemetra/rjdemetra")
```

 To install it you need Java8: in case you don't, install a portable version of Java8 and set the `JAVA_HOME` path.

What's next?  (1/2)

Documentation:

- Vignette/article for the Journal of Statistical Software
- Guide to install the package with portable version of Java (when you don't have administrator rights)
- Cheat sheet

What's next?  (2/2)

Package:

- Get only the Java object of a SA (to reduce computation/customize the output)
- Possibility to used user-defined calendar regressors (currently: only user-defined regressors)
- Function to "refresh" the model (JD+ 3.0.0)

Why and how use RJDemetra?

A package for quality assessment for seasonal adjustment. It implements:

- Statistics Canada Dashboard (to provide a snapshot of an individual series at a point in time and points out some possible problems)
- Insee quality report matrix (used to help the analyst during production to prioritize the models to check)

→ See the Seasonal Adjustment handbook

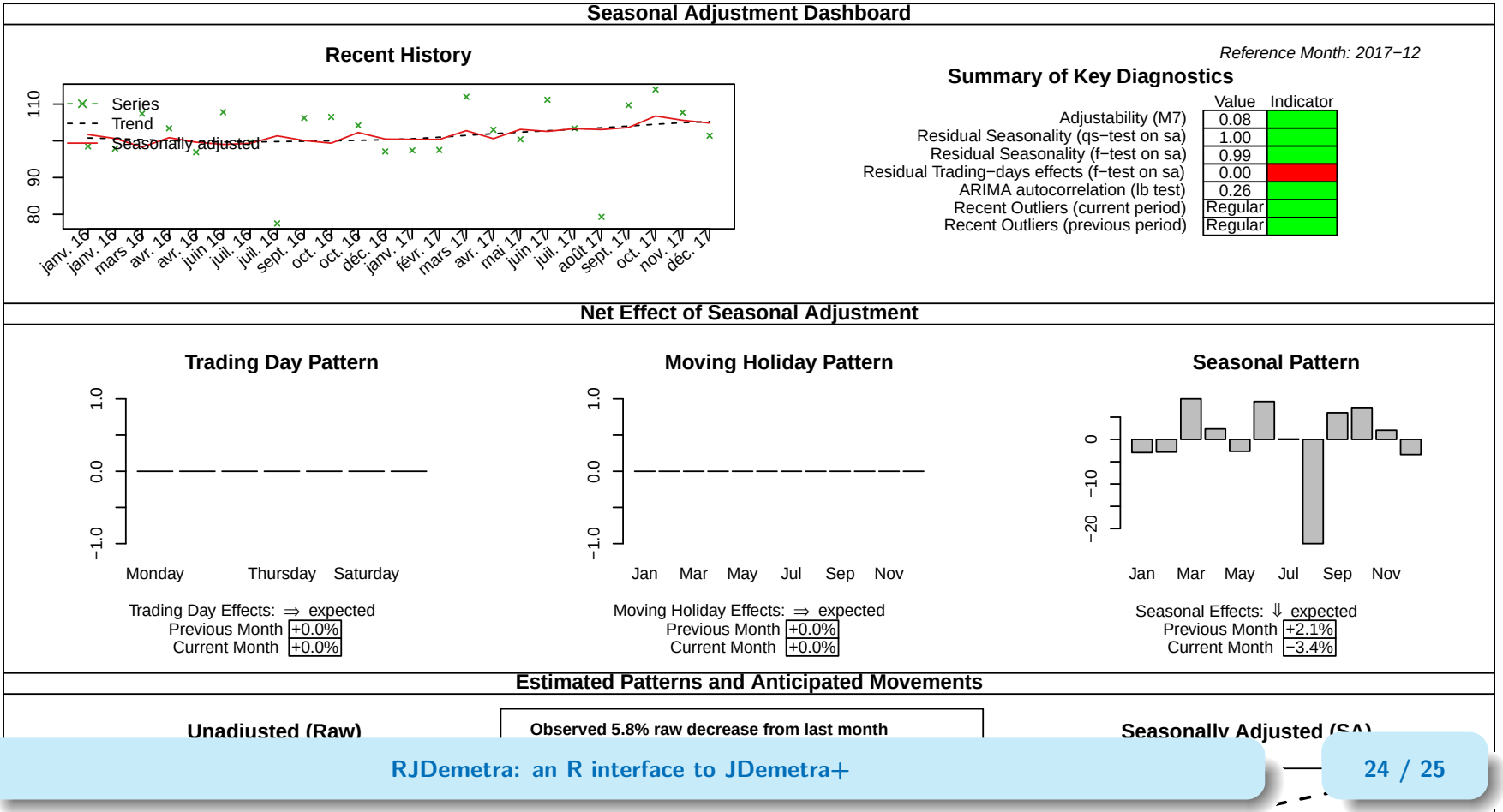
Available on github https://github.com/AQLT/rjdqa, still in development (only works for X13 models and no documentation yet)

Example of the dashboard:

```
library(rjdqa)
plot(sa_dashboard(x13_mod))
```

Example of the dashboard (1/2)

```
##
## Attaching package: 'rjdqa'

## The following object is masked _by_ '.GlobalEnv':
##
##     myseries
```



Example of the dashboard (2/2)

1. **Recent History of Series**: plot of the raw series, the SA series and the trend for the most recent periods. It is intended to identify trend direction, overall volatility and obvious outliers
2. **Summary of Key Diagnostics**: key diagnostics as residual seasonality, recent and recurring outliers, moving seasonality, ARIMA model autocorrelation
3. **Estimated Patterns and Anticipated Movements**: estimated trading day, moving holiday and seasonal pattern (rescaled in additive decomposition to represent relative level)
4. **Net Effect of Seasonal Adjustment**: movement in the raw series, compared to typical ranges centered around "neutral" value (when $SA_t = SA_{t-1}$)