rjdmarkdown with PDF output

The functions developped in `rjdmarkdown` are:

- `print_preprocessing()` for the pre-processing model;
- `print_decomposition()` for the decomposition;
- `print_diagnostics()` to print diagnostics tests on the quality of the seasonal adjustment.

The result is different between X-13ARIMA and TRAMO-SEATS models.

```
library(rjdmarkdown)
library(RJDemetra)
sa_x13 <- x13(ipi_c_eu[, "FR"])
sa_ts <- tramoseats(ipi_c_eu[, "FR"])
```

X-13-ARIMA model

```
print_preprocessing(sa_x13)
```

Pre-processing (RegArima)

Summary

372 observations

Trading days effect (7 variables)

Easter [1] detected

4 detected outliers

Likelihood statistics

Number of effective observations = 359

Number of estimated parameters = 17

Loglikelihood = -799.084, AICc = 1633.964, BICc = 1.855

Standard error of the regression (ML estimate) = 2.218

ARIMA model

Table 1: ARIMA coefficients

	Coefficients	Std. Error	T-stat	$\mathbb{P}(>\|t\|)$	
Phi(1)	0.000	0.108	0.003	0.998	
Phi(2)	0.169	0.074	2.278	0.023	*
Theta(1)	-0.549	0.102	-5.396	0.000	***
BTheta(1)	-0.666	0.042	-15.775	0.000	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

ARIMA (2,1,1)(0,1,1)

Regression model

Table 2: Regression coefficientss

	Coefficients	Std. Error	T-stat	$\mathbb{P}(>\|t\|)$	
Monday	0.559	0.228	2.453	0.015	*
Tuesday	0.882	0.228	3.864	0.000	***
Wednesday	1.040	0.229	4.535	0.000	***
Thursday	0.049	0.229	0.215	0.830	
Friday	0.911	0.230	3.964	0.000	***
Saturday	-1.578	0.228	-6.927	0.000	***
Leap year	2.154	0.705	3.054	0.002	**
Easter [1]	-2.380	0.454	-5.242	0.000	***
TC (4-2020)	-35.592	2.173	-16.377	0.000	***
AO (3-2020)	-20.890	2.180	-9.582	0.000	***
AO (5-2011)	13.499	1.857	7.269	0.000	***
LS (11-2008)	-12.549	1.636	-7.673	0.000	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```
print_decomposition(sa_x13, caption = NULL)
```

Decomposition (X-11)

Mode: additive

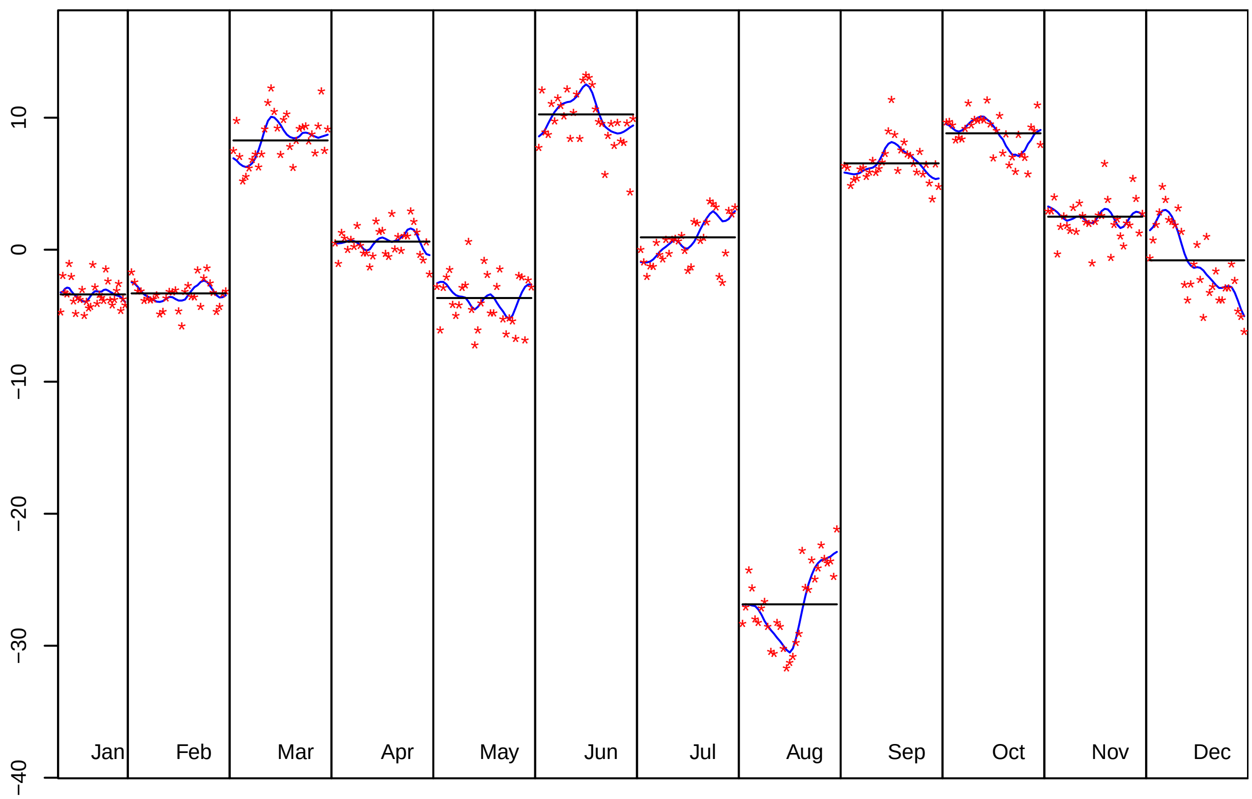

Figure 1: S-I Ratio

Table 3: M-statistics

	Value	Description
M-1	0.163	The relative contribution of the irregular over three months span
M-2	0.089	The relative contribution of the irregular component to the stationary portion of the variance
M-3	1.181	The amount of period to period change in the irregular component as compared to the amount of period to period change in the trend
M-4	0.558	The amount of autocorrelation in the irregular as described by the average duration of run
M-5	1.020	The number of periods it takes the change in the trend to surpass the amount of change in the irregular
M-6	0.090	The amount of year to year change in the irregular as compared to the amount of year to year change in the seasonal
M-7	0.083	The amount of moving seasonality present relative to the amount of stable seasonality
M-8	0.244	The size of the fluctuations in the seasonal component throughout the whole series
M-9	0.062	The average linear movement in the seasonal component throughout the whole series
M-10	0.272	The size of the fluctuations in the seasonal component in the recent years
M-11	0.256	The average linear movement in the seasonal component in the recent years
Q	0.368	
Q-M2	0.402	

Final filters: M3x5, Henderson-13 terms

Table 4: Relative contribution of the components to the stationary portion of the variance in the original series, after the removal of the long term trend

	Component
Cycle	2.251
Seasonal	59.750
Irregular	1.067
TD & Hol.	2.610
Others	33.718
Total	99.395

```
print_diagnostics(sa_x13)
```

Table 5: Diagnostics tests

	$\mathbb{P}(>\|t\|)$	
mean	0.899	
skewness	0.880	
kurtosis	0.034	*
ljung box	0.000	***
ljung box (residuals at seasonal lags)	0.212	
ljung box (squared residuals)	0.024	*
qs test on sa	0.985	
qs test on i	0.865	
f-test on sa (seasonal dummies)	0.958	
f-test on i (seasonal dummies)	0.893	
Residual seasonality (entire series)	0.876	
Residual seasonality (last 3 years)	0.906	
f-test on sa (td)	0.987	
f-test on i (td)	0.993	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

TRAMO-SEATS model

Some others graphics can also be added with the **`ggdemetra`** package, for example to add the seasonally adjusted series and its forecasts:

```r
library(ggdemetra)
ggplot(data = ipi_c_eu_df, mapping = aes(x = date, y = FR)) +
    geom_line() +
    labs(title = NULL,
         x = NULL, y = NULL) +
    geom_sa(component = "y_f", linetype = 2,
            frequency = 12, method = "tramoseats") +
    geom_sa(component = "sa", color = "red") +
    geom_sa(component = "sa_f", color = "red", linetype = 2)
```

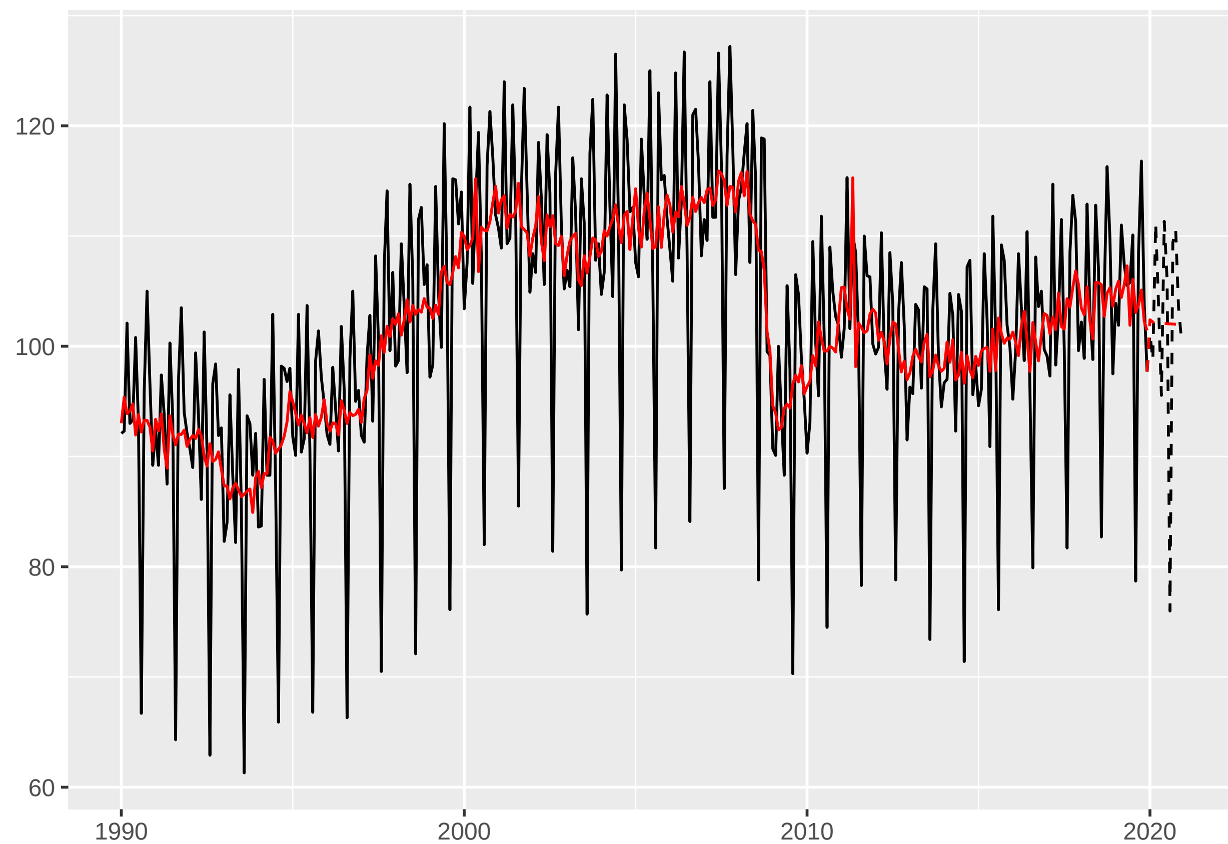

Figure 2: Seasonal adjustment of the French industrial production index

```
print_preprocessing(sa_ts)
```

Pre-processing (Tramo)

Summary

372 observations

Trading days effect (2 variables)

Easter [6] detected

4 detected outliers

Likelihood statistics

Number of effective observations = 359

Number of estimated parameters = 11

Loglikelihood = -816.075, AICc = 1654.912, BICc = 1.852

Standard error of the regression (ML estimate) = 2.326

ARIMA model

Table 6: ARIMA coefficients

	Coefficients	Std. Error	T-stat	$\mathbb{P}(>\|t\|)$	
Phi(1)	0.403	0.051	7.845	0.000	***
Phi(2)	0.288	0.051	5.616	0.000	***
BTheta(1)	-0.664	0.042	-15.865	0.000	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
ARIMA (2,1,0)(0,1,1)

Regression model

Table 7: Regression coefficientss

	Coefficients	Std. Error	T-stat	$\mathbb{P}(>\|t\|)$	
Week days	0.699	0.032	22.016	0.000	***
Leap year	2.323	0.690	3.367	0.001	***
Easter [6]	-2.515	0.436	-5.773	0.000	***
AO (5-2011)	13.468	1.787	7.535	0.000	***
TC (4-2020)	-22.213	2.205	-10.072	0.000	***
TC (3-2020)	-21.039	2.217	-9.492	0.000	***
AO (5-2000)	6.739	1.794	3.757	0.000	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```
print_decomposition(sa_ts, caption = NULL)
```

Decomposition (SEATS)

Mode: additive

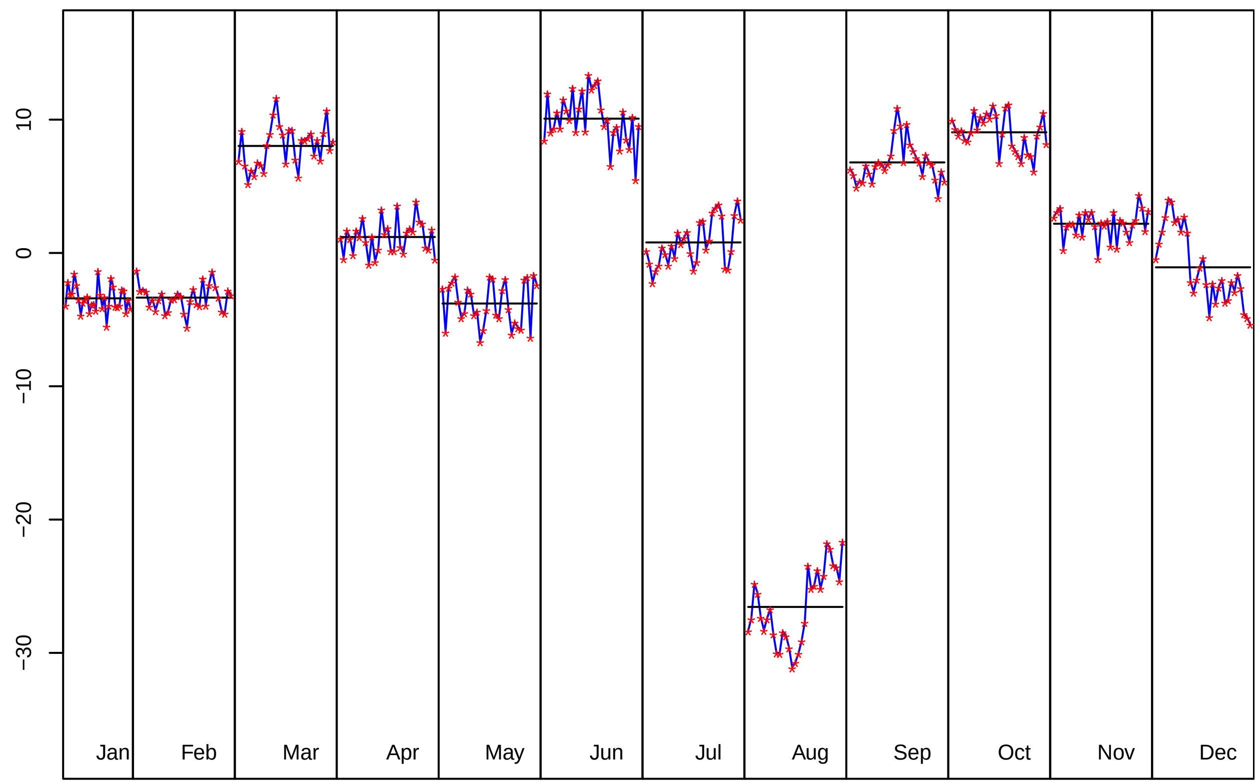

Figure 3: S-I Ratio

Model

AR: $1 + 0.403B + 0.288B^2$

D: $1 - B - B^{12} + B^{13}$

MA: $1 - 0.664B^{12}$

SA

AR: $1 + 0.403B + 0.288B^2$

D: $1 - 2.000B + B^2$

MA: $1 - 0.970B + 0.006B^2 - 0.006B^3 + 0.004B^4$

Innovation variance: 0.704

Trend

D: $1 - 2.000B + B^2$

MA: $1 + 0.034B - 0.966B^2$

Innovation variance: 0.061

Seasonal

D: $1 + B + B^2 + B^3 + B^4 + B^5 + B^6 + B^7 + B^8 + B^9 + B^{10} + B^{11}$

MA: $1 + 1.329B + 1.106B^2 + 1.185B^3 + 1.068B^4 + 0.821B^5 + 0.632B^6 + 0.404B^7 + 0.245B^8 + 0.002B^9 - 0.056B^{10} - 0.204B^{11}$

Innovation variance: 0.043

Transitory

AR: $1 + 0.403B + 0.288B^2$

MA: $1 - 0.260B - 0.740B^2$

Innovation variance: 0.053

Irregular

Innovation variance: 0.203

Table 8: Relative contribution of the components to the stationary portion of the variance in the original series, after the removal of the long term trend

	Component
Cycle	6.087
Seasonal	80.528
Irregular	0.965
TD & Hol.	3.590
Others	8.102
Total	99.271

```
print_diagnostics(sa_ts)
```

Table 9: Diagnostics tests

	$\mathbb{P}(>\|t\|)$	
mean	0.988	
skewness	0.413	
kurtosis	0.095	.
ljung box	0.010	**
ljung box (residuals at seasonal lags)	0.192	
ljung box (squared residuals)	0.000	***
qs test on sa	1.000	
qs test on i	1.000	
f-test on sa (seasonal dummies)	1.000	
f-test on i (seasonal dummies)	1.000	
Residual seasonality (entire series)	1.000	
Residual seasonality (last 3 years)	0.974	
f-test on sa (td)	0.152	
f-test on i (td)	0.224	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Directly create a R Markdown file

A R Markdown can also directly be created and render with the `create_rmd` function. It can take as argument a `SA`, `jSA`, `sa_item`, `multiprocessing` (all the models of the `multiprocessing` are printed) or workspace object (all the models of all the `multiprocessing` of the `workspace` are printed).

The print of the pre-processing, decomposition and diagnostics can also be customized with `preprocessing_fun`, `decomposition_fun` and `diagnostics_fun` arguments. For example, to reproduce the example of the previous section:

```
preprocessing_customized <- function(x){
  library(ggdemetra)
  y <- get_ts(x)
  data_plot <- data.frame(date = time(y), y = y)
  p <- ggplot(data = data_plot, mapping = aes(x = date, y = y)) +
    geom_line() +
    labs(title = NULL,
         x = NULL, y = NULL) +
    geom_sa(component = "y_f", linetype = 2,
            frequency = 12, method = "tramoseats") +
    geom_sa(component = "sa", color = "red") +
    geom_sa(component = "sa_f", color = "red", linetype = 2)
  plot(p)
  cat("\n\n")
  print_preprocessing(sa_ts)
}
decomposition_customized <- function(x){
  print_decomposition(x, caption = NULL)
}

output_file <- tempfile(fileext = ".Rmd")

create_rmd(sa_ts, output_file, output_format = "pdf_document",
           preprocessing_fun = preprocessing_customized,
           decomposition_fun = decomposition_customized,
           knitr_chunk_opts = list(
             fig.pos = "h", results = "asis",
             fig.cap =c("Seasonal adjustment of the French industrial production index",
                        "S-I Ratio"),
             warning = FALSE, message = FALSE, echo = FALSE)
           )
# To open the file:
browseURL(sub(".Rmd",".pdf", output_file, fixed= TRUE))
```

Several models can also be printed creating a workspace:

```
wk <- new_workspace()
new_multiprocessing(wk, "sa1")
add_sa_item(wk, "sa1", sa_x13, "X13")
add_sa_item(wk, "sa1", sa_ts, "TramoSeats")
# It's important to compute the workspace to be able to import the models
compute(wk)

output_file <- tempfile(fileext = ".Rmd")
create_rmd(wk, output_file, output_format = "pdf_document",
           output_options = list(toc = TRUE,
                                 number_sections = TRUE))
# To open the file:
browseURL(sub(".Rmd",".pdf", output_file, fixed= TRUE))
```

Reproductibility

For PDF outputs, the following package must be used.

```
header-includes:
   - \usepackage{booktabs}
   - \usepackage{float}
   - \usepackage{array}
   - \usepackage{multirow}
   - \floatplacement{figure}{H}
```

To produce this document, the `knitr` options were set as followed:

```r
knitr::opts_chunk$set(collapse = TRUE,
  comment = "#>", fig.pos = "h",
  warning = FALSE, message = FALSE
)
```

And the options `results='asis', fig.cap = "S-I Ratio"` were used in the chunks.