x12simldoc92

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1 Seasonal Adjustment by Using X12SIML

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1.1 X12SIML (Ver.92)

- Seasonal adjustment based on the SIML method.
- References : Sato and Kunitomo (2020, 2021) :
  http://www.mims.meiji.ac.jp/publications/2020-ds/SDS-15.pdf
  http://www.mims.meiji.ac.jp/publications/2021-ds/SDS-20.pdf
- It is like X-12ARIMA of the U.S. Census Bureau with outlier detections.
- Works in R.
- I has auto-outlier detections such as AO, LS, RAMP, and others.
- It is possible to define regression variables in the program.
- Install source program (“x12siml8.R”). No need for other libraries.

[1]:
```
source("x12siml92.R")
```

1.2 How to use x12siml

“x12siml” <- function(data, reg = NULL, trend = 2, ilog = 0, frequency = 4, start = c(1994, 1), iplot = T, sorder = 1, mtype=1, pb=2,pa=2, ...)

- In reg, you can insert user defined explanatory variables.
- In trend and sorder, insert positive integers. The larger values mean more flexibility on trend and seasonality. As a suggestion, use the number of 10% of data for trend and 1∼3 for sorder.

- pb is the cylce number of naive predictions and pa is the cylce number of naive backcasts. pb and pa can be used to stabilize the estimates of seasonal states when the number of data is not large.
- mtype is the SIML filter-type. It is 1 for forward-filter and 2 for the backward-filter.
- In ... , you can use the outlier variables in the following list.
- Structural Breaks and Outliers
  - AO (additive outlier)
  - LS (level shift)
  - TC (temporaly change)
  - RAMP (slope change shift, ramp)
  - VAT
  - Holiday
  - Leap Year
  - TCRAMP(RAMP+TC)
  - TCRAMP1(RAMP+(one blank)+TC)

- **Outlier variables**
- AO > x12siml(data,start=c(1993,1),frequency=4,ao=c(2001,2))
  (AO is setted at 2001Q2.)
- LS > x12siml(data,start=c(1993,1),frequency=4,ls=c(2001,2))
  (LS is setted at 2001Q2.)
- RAMP > x12siml(data,start=c(1993,1),frequency=4,rp=c(2001,2,2001,4))
  (RAMP is setted from 2001Q2 to Q4.)
- TLS > x12siml(data,start=c(1993,1),frequency=4,tls=c(2001,2,2001,4))
  (TLS(temporary level shift) is setted from 2001Q2 to Q4.)
- TC > x12siml(data,start=c(1993,1),frequency=4,tc=c(2001,2))
  (TC is setted at 2001Q2.)
- VAT > x12siml(data,start=c(1993,1),frequency=4,vat=c(2001,1))
  (VAT dummy (1 at the selected pwriod and -1 in the next period).)
- VATT > x12siml(data,start=c(1993,1),frequency=4,vatt=c(2001,1))
  (VATT dummy (1 at the selected pwriod and -1 in the next period with a trend).)
- Holiday > x12siml(data,start=c(1993,1),frequency=4,hol=c(2001,3,2003,4))
  (Dummies as AO with several periods (the resulting estimates are in the estimated seasonal).)
- LeapYear > x12siml(data,start=c(1993,1),frequency=4, ly=c(1996,1))
  (Set AO at each 4*frequency after the selected period.)
- SLS > x12siml(data,start=c(1993,1),frequency=4, sls=c(2003,4))
  (Level shift in seasonals at the selected period.)
- TCRAMP > x12siml(data,start=c(1993,1),frequency=4,tcrp=c(2001,2,2001,4,2003,3))
  (Set TCRAMP from 2001Q2 to 2002Q3 (RAMP from 2001Q2 to 2001Q4 and TC from

2001Q4 to 2003Q3).)

- TCRAMP1 > x12siml(data,start=c(1993,1),frequency=4,tcrp1=c(2001,2,2001,4,2003,3)) (Set TCRAMP1 from 2001Q2 to 2002Q3 (RAMP from 2001Q2 to 2001Q4 and TC from 2002Q1 to 2003Q3).)

[ ]:

```

```

[2]:

```
TCRATE <- 0.8^2
start <- c(1993,1)
frequency <- 4
reg2 <- list(ao=c(2001,2),ls=c(2001,2),rp=c(2001,2,2001,4),
            tc=c(2001,2), vat=c(2001,1),hol=c(2001,3,2003,4), sls=c(2003,4),
            ly=c(1996,1),  tcrp=c(2001,2,2001,4,2003,3),tls=c(2001,2,2001,4),
             tcrp1=c(2001,2,2001,4,2003,3)
            )
```

[5]:

```
data <- rnorm(100)
        n <- length(data)
    nn <- length(reg2)
    dimnames.reg <- NULL
    reg <- NULL

        if(nn > 0) {
                for(i in seq(nn)) {
                    switch(names(reg2[i]),
                           "ls"={
                                z <- rep(0, n)
                                tt <- sum((reg2[[i]] - start) * c(frequency,␣
↪1)
                                  ) + 1
                                z[1:(tt - 1)] <- -1
                                z <- z+1
                                reg <- cbind(reg, z)
                        },
                        "tc"= {
                            tcrate <- TCRATE #0.6999999999999996^(12/
↪frequency)
                                z <- rep(0, n)
```

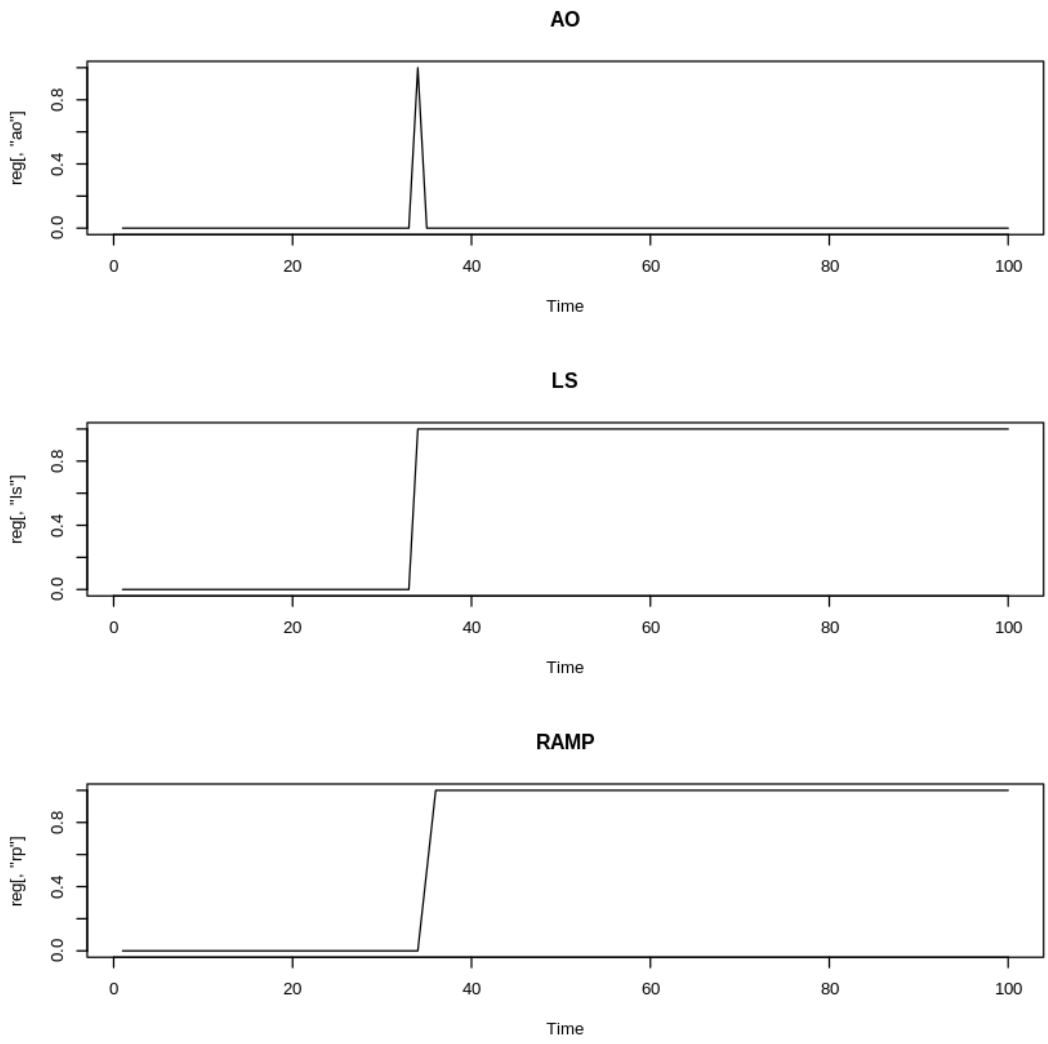
```
                                tt <- sum((reg2[[i]] - start) * c(frequency,␣
↪1)
                                  ) + 1
                                z[tt:n] <- tcrate^(0:(n - tt))
                                reg <- cbind(reg, z)
                        },
                        "ao"= {
                                z <- rep(0, n)
                                tt <- sum((reg2[[i]] - start) * c(frequency,␣
↪1)
                                  ) + 1
                                z[tt] <- 1
                                reg <- cbind(reg, z)
                        },
                        "hol"= {
                                z <- rep(0, n)
                nnn2 <- length(reg2[[i]])/2
                for(j in seq(nnn2)) {
                                tt <- sum((reg2[[i]][j*2-(1:
↪0)]-start)*c(frequency,1)
                                  ) + 1
                                z[tt] <- 1
                    }
                                reg <- cbind(reg, z)
                        },
                        "sls"= {
                                z <- rep(0, n)
        nyy <- floor(n/frequency)+1
        yyy <- c(rep(start[1],frequency-start[2]+1),
                  t(matrix(rep((start[1]+1):(start[1]+nyy),frequency),
                           nrow=nyy)))[1:n]
        mmm <- c((start[2]):frequency,rep(1:frequency,nyy))[1:n]
        sty <- reg2[[i]][1]
        stm <- reg2[[i]][2]
        z[yyy >= sty] <- -1/(frequency-1)
        z[yyy >= sty & mmm==stm] <- 1
                                reg <- cbind(reg, z)
```

```
                    },

          "ly"= {
                 z <- rep(0, n)
                 if(length(reg2[[i]])==1)
                          tt <- reg2[[i]]+(0:n)*(frequency*4)
                       else
                          tt <- sum((reg2[[i]] - start) * c(frequency,␣
↪1)
                            ) + 1 + (0:n)*(frequency*4)
                          z[tt] <- 1
                          z <- z[1:n]
                          reg <- cbind(reg, z)
                    },

                    "vat"={
                          z <- rep(0, n)
                          tt <- sum((reg2[[i]] - start) * c(frequency,␣
↪1)
                            ) + 1
                          z[tt] <- 1
                          z[tt + 1] <- -1
                          reg <- cbind(reg, z)
                    },
                    "rp"= {
                          z <- rep(0, n)
                          tt1 <- sum((reg2[[i]][1:2] - start) * c(
                            frequency, 1)) + 1
                          tt2 <- sum((reg2[[i]][3:4] - start) * c(
                            frequency, 1)) + 1
                          z[1:(tt1)] <- -1
                          z[(tt1 + 1):(tt2 - 1)] <- (((tt1 + 1):(tt2 -␣
↪1)
                          ) - tt1)/(tt2 - tt1) - 1
                          z <- z+1
                          reg <- cbind(reg, z)
                    },
```

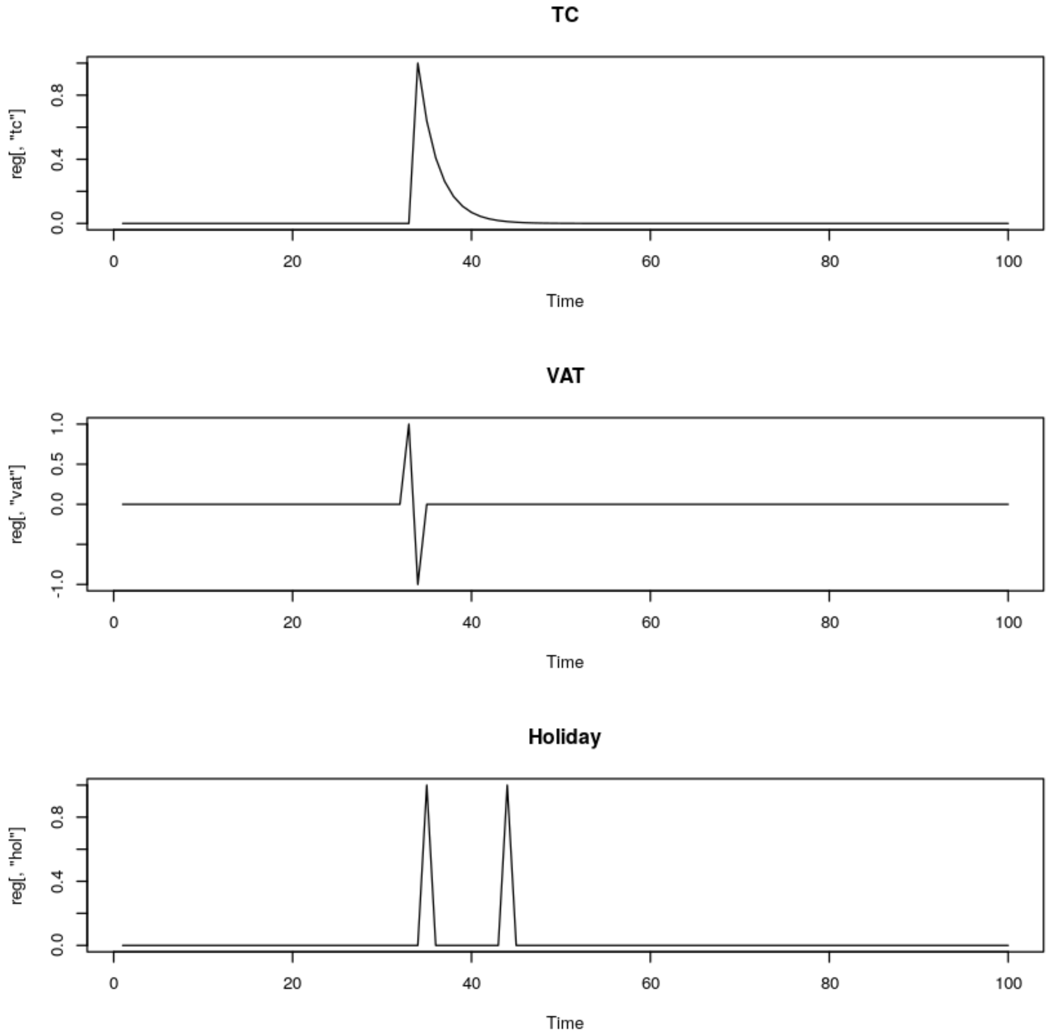
```
            "tls"= {
                        z <- rep(0, n)
                        tt1 <- sum((reg2[[i]][1:2] - start) * c(
                          frequency, 1)) + 1
                        tt2 <- sum((reg2[[i]][3:4] - start) * c(
                          frequency, 1)) + 1
                        z[(tt1):tt2] <- 1
                        reg <- cbind(reg, z)
                    },
                    "tcrp"= {
                        z <- rep(0, n)
                        tt1 <- sum((reg2[[i]][1:2] - start) * c(
                          frequency, 1)) + 1
                        tt2 <- sum((reg2[[i]][3:4] - start) * c(
                          frequency, 1)) + 1
                        tt3 <- sum((reg2[[i]][5:6] - start) * c(
                          frequency, 1)) + 1
                        tcrate <- TCRATE
#                        z[1:(tt1)] <- -1
                        z[(tt1 + 1):(tt2 - 1)] <- (((tt1 + 1):(tt2 -
 ↪1)

                          ) - tt1)/(tt2 - tt1)
                        z[(tt2):tt3] <- tcrate^(0:(tt3 - tt2))
                        z[tt3:n] <- z[tt3]
                        reg <- cbind(reg, z)
                    },
                    "tcrp1"= {
                        z <- rep(0, n)
                        tt1 <- sum((reg2[[i]][1:2] - start) * c(
                          frequency, 1)) + 1
                        tt2 <- sum((reg2[[i]][3:4] - start) * c(
                          frequency, 1)) + 1
                        tt3 <- sum((reg2[[i]][5:6] - start) * c(
                          frequency, 1)) + 1
                        tcrate <- TCRATE
              #0.8000000000000004          #^(12/frequency)
#                        z[1:(tt1)] <- -1
```

```
                                z[(tt1 + 1):(tt2 - 1)] <- (((tt1 + 1):(tt2 -␣
↪1)
                                  ) - tt1)/(tt2 - tt1)
                                z[tt2] <- 1
                                z[(tt2 + 1):tt3] <- tcrate^(0:(tt3 - tt2 -␣
↪1))
                                z[tt3:n] <- z[tt3]
                                reg <- cbind(reg, z)
                        },
                        {
                            nn <- nn-1
                            cat(paste("Warning:",names(reg2[i]), "is not␣
↪supported\n"))
                            reg2[i] <- NULL
                        }
                        )
                  }
        }
        dimnames(reg) <- list(NULL,names(reg2))
```

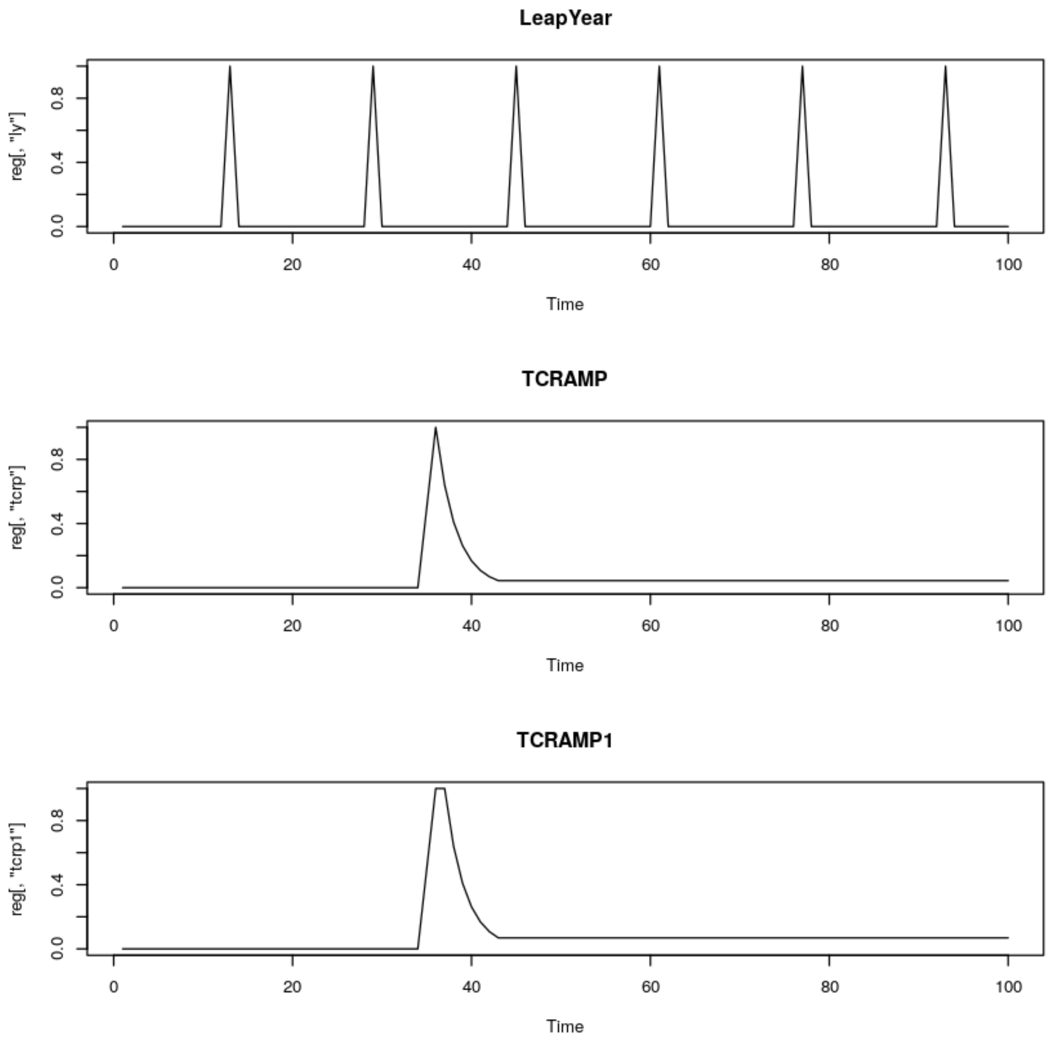
[6]:
```
par(mfrow=c(3,1))
plot.ts(reg[,"ao"],main="AO")
plot.ts(reg[,"ls"],main="LS")
plot.ts(reg[,"rp"],main="RAMP")
```



[11]:
```
par(mfrow=c(3,1))
plot.ts(reg[,"tc"],main="TC")
plot.ts(reg[,"vat"],main="VAT")
plot.ts(reg[,"hol"],main="Holiday")
```

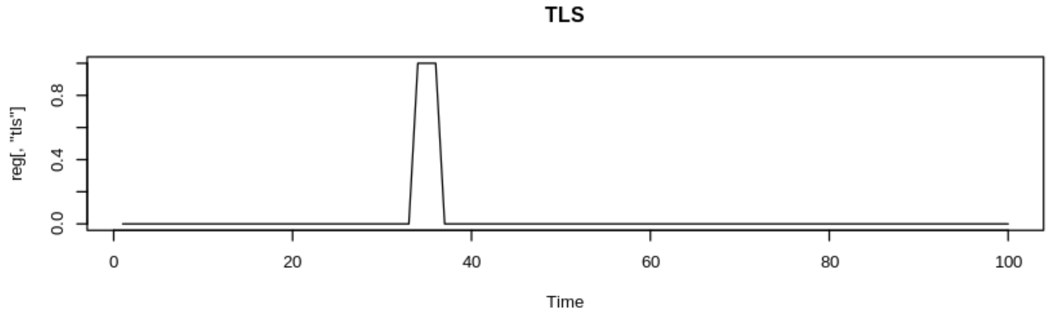


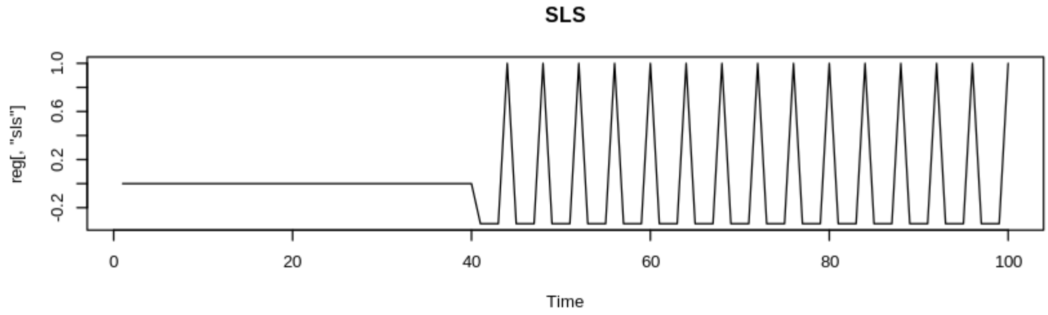
[18]:
```r
par(mfrow=c(3,1))
plot.ts(reg[,"ly"],main="LeapYear")
plot.ts(reg[,"tcrp"],main="TCRAMP")
plot.ts(reg[,"tcrp1"],main="TCRAMP1")
```



[6]:

```
par(mfrow=c(3,1))
plot.ts(reg[,"tls"],main="TLS")
plot.ts(reg[,"sls"],main="SLS")
```





1.3 Seasonal Frequency

- We set the seasonal frequency as s (that is, $s = 12$ for monthly data, $s = 4$ for qurterly data）.
- We usually observe seasonal fluctuations at f_s :

$$f_s = (\frac{1}{s}, \frac{2}{s}, \cdots, \frac{[s/2]}{s})$$

$$f_{12} = (\frac{1}{12}, \frac{2}{12}, \cdots, \frac{6}{12})$$

$$f_7 = (\frac{1}{7}, \frac{2}{7}, \frac{3}{7})$$

$$f_4 = (\frac{1}{4}, \frac{2}{4})$$

- We set the seasonal band with sorder (flexible seasonals) :

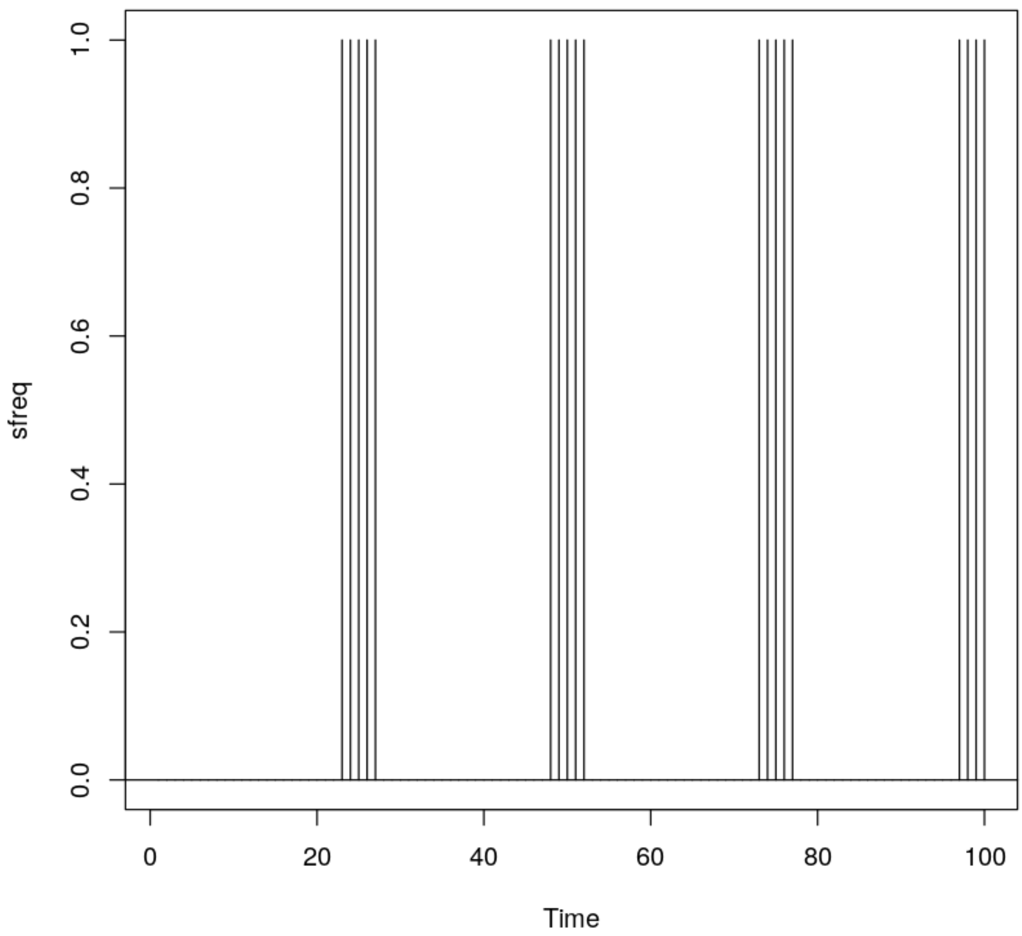
$$ind_s = (2 * f_s * n - sorder) : (2 * f_s * n + sorder)(\leq n)$$

$$ind_4 = (n/2 - sorder) : (n/2 + sorder), (n - sorder) : n$$

We assume that the number 1∼n in the x-axis corresponds to 0~1/2.

[2]:
```
h <- 0
n1 <- 100
frequency <- 8
sorder <- 2
period <- frequency

if(F) {
            sid <- ceiling(2*(n1+h)/period)+(-sorder):(sorder)
        if(period==4) { sid <- c(sid,n1-(( max(sorder+1-h,0) ):0))}
        if(period==12) {
            sid <- c(sid,ceiling(4*(n1+h)/period)+(-sorder):(sorder))
            sid <- c(sid,ceiling(6*(n1+h)/period)+(-sorder):(sorder))
            sid <- c(sid,ceiling(8*(n1+h)/period)+(-sorder):(sorder))
            sid <- c(sid,ceiling(10*(n1+h)/period)+(-sorder):(sorder))
            sid <- c(sid,n1-(( max(sorder+1-h,0) ):0))
        }
        if(period==7) {
            sid <- c(sid,ceiling(4*(n1+h)/period)+(-sorder):(sorder))
            sid <- c(sid,ceiling(6*(n1+h)/period)+(-sorder):(sorder))
           ## sid <- c(sid,n1-(( max(sorder+1-h,0) ):0))
        }
        }


sid <- ceiling(2*(n1+h)/period)+(-sorder):(sorder)
    if(period > 4) {
    for(i in 2:(ceiling(period/2)-1)) {
            sid <- c(sid,ceiling(2*i*(n1+h)/period)+(-sorder):(sorder))
             }
          }
if(period %% 2 == 0)  sid <- c(sid,n1-(( max(sorder+1-h,0) ):0))
sfreq <- rep(0,n1)
sfreq[sid] <- 1
```

```r
plot.ts(sfreq,type="h")
abline(h=0)
```



1.4 Regression (regsiml)

- A) We set the K_n transformed data as Z, the K_n transformed regression variables as $Z^{(d)}$.

$$z = PC^{-1}y, Zd = PC^{-1}W$$

- B) From Z, select the seasonal band and construct Z_s.

$$z_s = J_s z$$

J_s is the selection matrix to find the seasonal bands.

- C) From Z, select bands except the seasonal bands and construct Z_{-s} .

$$z_{-s} = J_{-s}z$$

J_{-s} is the selection matrix chooshing bands except the seasonal bands.

- D) From Z_{-s}, form Z_t by selecting the first m terms (m is trend).

$$z_t = J_m z$$

J_m is the selection transformation of the first m terms.

- E) For $Z^{(d)}$, construct $Z_s^{(d)}$,$Z_{-s}^{(d)}$,$Z_t^{(d)}$ in the same way.

$$Zd_s = J_s Zd, Zd_{-s} = J_{-s}Zd, Zd_t = J_m Zd$$

- F) Regression A : Regress Z_t on $Z_t^{(d)}$ with 0 intercept.

$$C_t = (Zd_t' Zd_t)^{-1} Zd_t' z_t$$

- G) Regression B : Regress Z_{-s} on $Z_{-s}^{(d)}$ with 0 intercept.

$$C_{-s} = (Zd_{-s}' Zd_{-s})^{-1} Zd_{-s}' z_{-s}$$

- H) When the dummy variables include one of AO, VAT, HOL, LY, then, compare the F values to select the results of either Regression A or Regression B. Otherwise, Regression A is chosen.

- I) By running Regression, obtain the regressison coefficients "coef" and the residuals "res".

$$C = C_t \ or \ C_{-s}, res = J_m' z_t - Zd_t C_t \ or \ J_{-s}' z_{-s} - Zd_{-s} C_{-s}$$

- J) Z_{s*} is the residuals of $Z_s^{(d)}$ minus coef times Z_s .

$$z_s* = z_s - Zd_s C$$

- K) Z_{t*} is composed of the first m terms of res and set 0 otherwise,

$$z_t* = J_m res$$

- L) The inverse transformations of Z_{s*} and Z_{t*} are the seasonal S and trend Tr .

$$S = CP' J_s' z_s*, Tr = CP' J_m' z_t*$$

- M) AIC of Regression A is AIC.a and AIC of Regression B is AIC.b . (We multiple n1 instead of n to Log of estimated variances.)

[8]:
```
## regsiml
   mat <- siml.mat(n,m1,type=mtype)
## type=1 (前向き), 2 (後ろ向き)
    n1 <- dim(mat$K)[1]
## A)
    z.y <- mat$K %*% c(data)
    z.d <- mat$K %*% reg
    z.s <- z.y
## B)
    z.s[-sid] <- 0
## C)
    z.y[sid] <- 0
## D)E)F)
        zz <- lsfit(z.d[1:m1,],z.y[1:m1],inter=F)
          vvv2 <- mean((zz$res)^2)

##  G)
         zz.tmp <- lsfit(z.d[-sid,],z.y[-sid],inter=F)
          vvv3 <- mean((zz.tmp$res)^2)

    if( "F of zz" < "F of zz.tmp" and (ao or vat or ly or hol) ) zz <- zz.tmp

## K)
        res <- c(zz$res,rep(0,n1-m1))

## J)
           z.s[sid] <- z.s[sid]-c(z.d %*% zz$coef)[sid]

## L)
   trend <- mat$inv %*% res
    seasonal <- mat$inv %*% z.s

## M)
       para <- log(c(vvv2,vvv3))*n1+2*(k+1)
```

```
Error in makeMat21(n, m, type = type): object 'm1' not found
Traceback:
```

```
1. siml.mat(n, m1, type = mtype)
2. makeMat21(n, m, type = type)
```

1.5 Result (x12siml)

- In x12siml, we use the results of regsiml to make figures.
Among dummy variables, except “ao”,“vat”,“hol”,“ly” the effects are included in the estimated trend. The variables “hol” and “ly” are included in the estimated seasonals The variables “ao” and “vat’ are included in the estimated noise.’

[ ]:
```
zz <- regsiml(data, reg, m1 = trend, log = ilog, period =
                    frequency, sorder = sorder,
                      mtype=mtype, pb=pb, pa=pa)

                if(ilog > 0)
                        data <- log(data)
                z.trend <- zz$trend
                if(!is.null(reg)) {
                    zz.dumm <- seq(ncol(zz$trade))
                    zz.dumm <- zz.dumm[dimnames(zz$trade)[[2]] != "ao" &
                                       dimnames(zz$trade)[[2]] != "vat" &
                                       dimnames(zz$trade)[[2]] != "hol" &
                                       dimnames(zz$trade)[[2]] != "ly"
                                       ]
                    if(length(zz.dumm) >0) {
                        z.trend <- z.trend + c(apply(zz$trade[,zz.
↪dumm,drop=F],1,sum)) }
                    }
                    zz.seasonal <- zz$seasonal
    if(any(dimnames(reg)[[2]] == "ly"))
                    zz.seasonal <- zz.seasonal+zz$trade[,"ly"]
    if(any(dimnames(reg)[[2]] == "hol")) {
                    ididi <- seq(nn0)[dimnames(reg)[[2]] == "hol"]
                    for(ijij in ididi) {
                    zz.seasonal <- zz.seasonal+zz$trade[,ijij]
                        }
                    }
```

```
z.adj <- data - zz.seasonal
zz.noise <- data-(zz.seasonal+z.trend)
```

1.6 Outlier Auto-detection

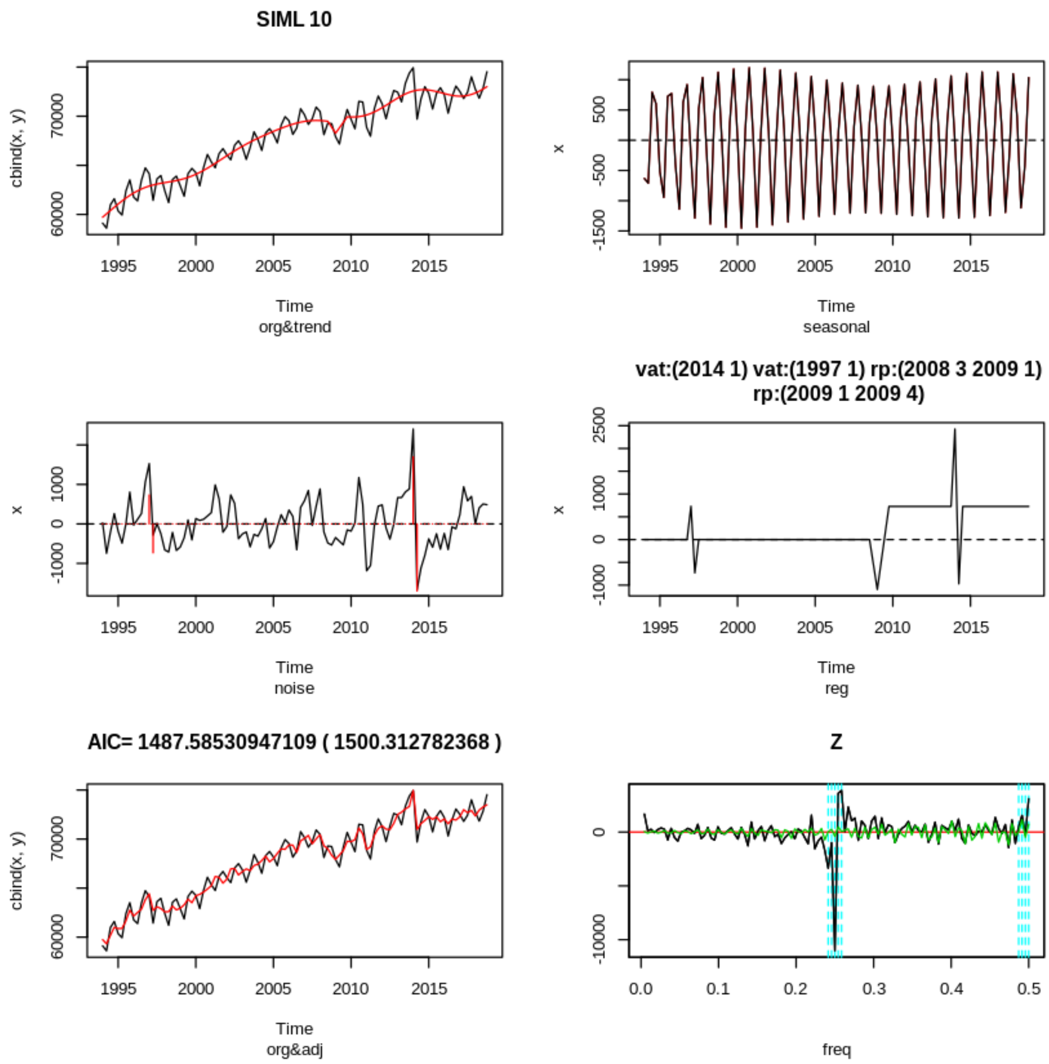
outlier(data, start=c(1998,1), frequency=12,type="ao",tt=c(1999,1,2009,12))

- We search AO from 1999, January to 2009 December. Search one period to improve AIC with certain value (the default is 4).
- To detect multiple periods, set : > outlier(data, start=c(1998,1), frequency=12,type="ao",tt=c(2001,4,2009,12), ao=c(2001,3))
  - (Some care should be made not to take double counts of period.)
- Fo type, you can use "ao", "ls", "tc", "rp" .
- Auto-search of TKRAMP and/or TCRAMP
- Auto-search tkramp during 2008, January〜2010, December. (It may take time if the search length is long.)
- TKRAMP is the double RAMP（Takaoka-RAMP, RAMP+RAMP）
- Search one period to improve AIC with certain value (the default is 4).
- To use detection with other outliers, use : > tkramp(data, start=c(1996,1), frequency=4,tt=c(2008,1,2010,12), ls=c(2001,3))
- The same for tcramp : > tcramp(data, start=c(1996,1), frequency=4,tt=c(2008,1,2010,12))

[2]:
```
zz <- x12siml(shouhi,sorder=2,trend=10,frequency=4,start=c(1994,1),
             vat=c(2014,1),vat=c(1997,1),
              rp=c(2008,3,2009,1),rp=c(2009,1,2009,4))
#zz <- x12siml(shouhi,sorder=2,trend=10,rp=c(2008,2,2009,1),vat=c(2014,1))
## If you want to include VAT dummy variable to trend.
%(VAT ダミーをトレンドに入れたい場合)


#plot.ts(zz$trend+zz$dummy[,"vat"])
```

```
[1] "make mat"
      vat        vat         rp         rp
11664.552 95997.246 -4679.330  4536.477
```

```
      vat        vat         rp         rp
 1698.4904   731.3393 -1095.7953  1823.0909
Residual Standard Error=753.1881
R-Square=0.1588
F-statistic (df=4, 6)=0.2832
p-value=0.8788

     Estimate    Std.Err t-value Pr(>|t|)
vat 11664.552 140435.672  0.0831   0.9365
vat 95997.246  94214.217  1.0189   0.3476
rp  -4679.329   9227.136 -0.5071   0.6302
rp   4536.477   9897.715  0.4583   0.6628


Residual Standard Error=628.1707
R-Square=0.3265
F-statistic (df=4, 103)=12.4845
p-value=0

      Estimate   Std.Err t-value Pr(>|t|)
vat  1698.4904  274.1562  6.1953   0.0000
vat   731.3393  277.7734  2.6329   0.0098
rp  -1095.7953  907.0976 -1.2080   0.2298
rp   1823.0909 1101.7570  1.6547   0.1010
```



[9]:

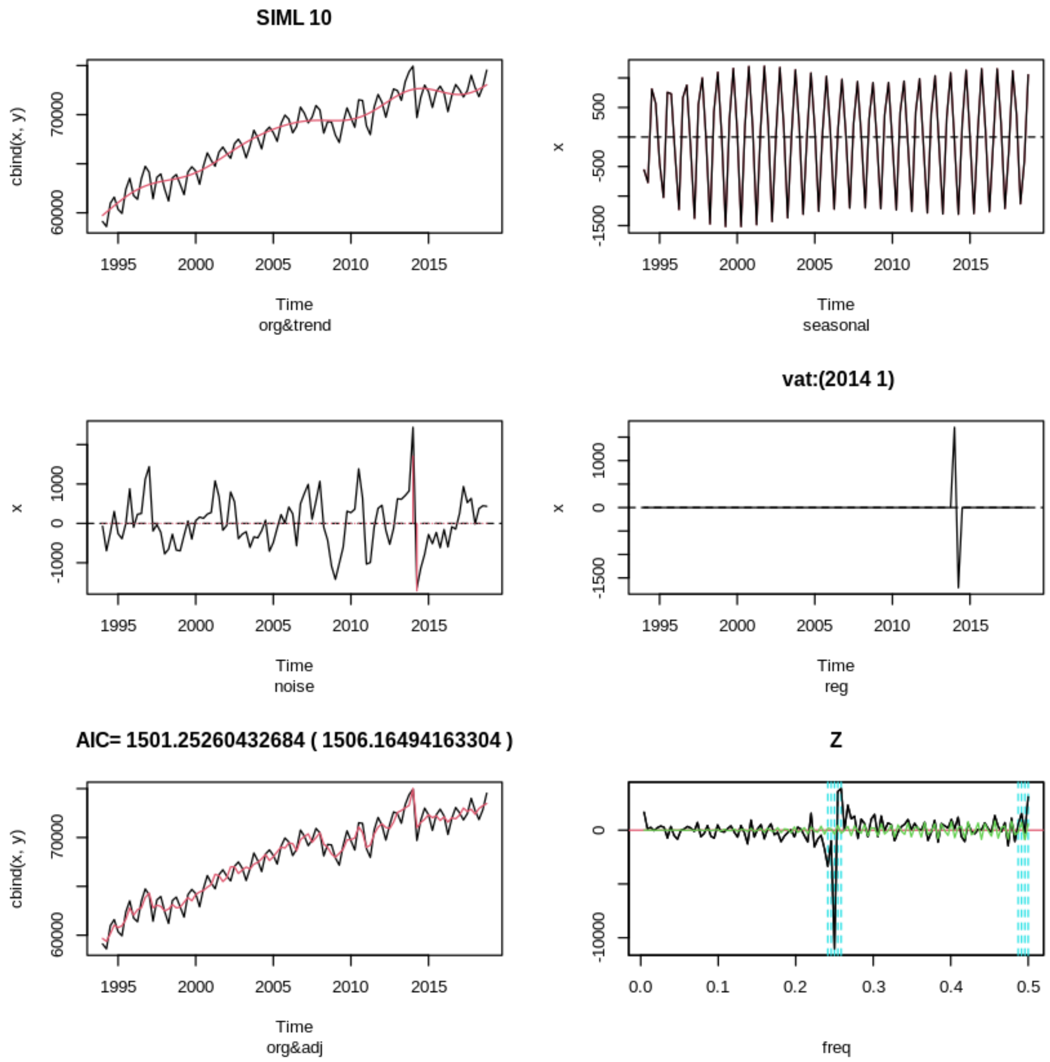
```
zz <-␣
↪outlier(shouhi,sorder=2,trend=10,type="ao",tt=c(2012,1,2015,1),vat=c(2014,1))
## VAT ダミーをトレンド入れたい場合
plot.ts(zz$trend+zz$dummy[,"vat"])
```

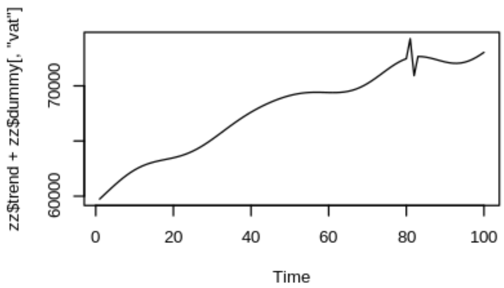
```
[1] "make mat"
       X
14613.06
       X
1708.676
Residual Standard Error=669.3823
R-Square=0.0034
F-statistic (df=1, 9)=0.0307
```

```
p-value=0.8648

  Estimate  Std.Err t-value Pr(>|t|)
X 14613.06 83426.11  0.1752   0.8648


Residual Standard Error=651.6736
R-Square=0.2541
F-statistic (df=1, 106)=36.1055
p-value=0

  Estimate  Std.Err t-value Pr(>|t|)
X 1708.676 284.3632  6.0088        0


      ao      vat
-32341.1 187586.3
       ao       vat
 403.5853 1731.1860
       ao       vat
-13082.94  83211.63
       ao       vat
```

（中略）

```
      ao      vat
20261.99 78383.67
        ao        vat
 -64.45557 1711.58885
      ao      vat
22799.13 99500.00
       ao       vat
 442.8487 1742.4985
```

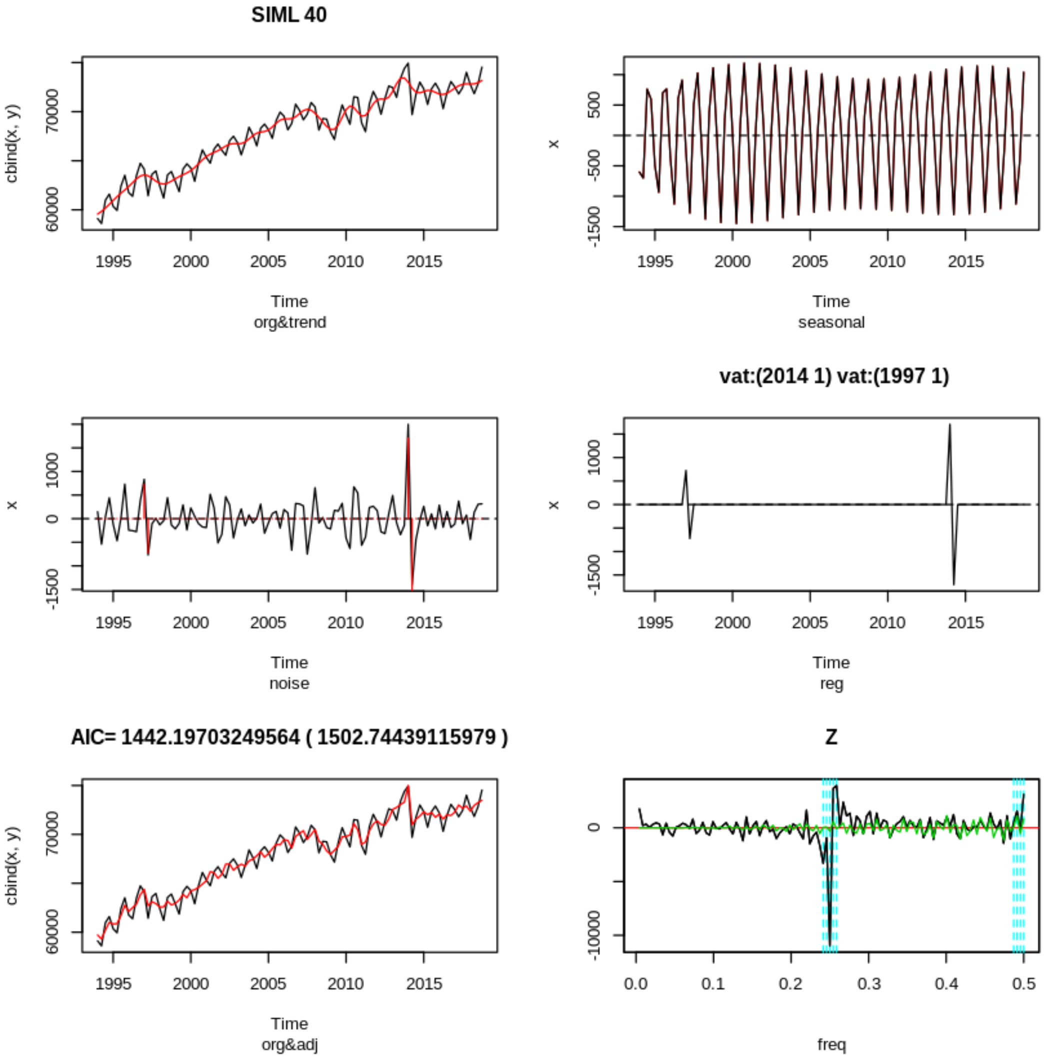

SIML 10
cbind(x, y)
60000
70000
1995
2000
2005
2010
2015
Time
org&trend
x
500
-500
-1500
Time
seasonal
vat:(2014 1)
x
1000
0
-1000
Time
noise
x
1000
0
-1500
Time
reg
AIC= 1501.25260432684 (1506.16494163304)
cbind(x, y)
60000
70000
Time
org&adj
Z
0
-10000
0.0
0.1
0.2
0.3
0.4
0.5
freq



[3]:
```
source("x12siml92.R")
zz <- x12siml(shouhi,sorder=2,trend=40,frequency=4,start=c(1994,1),
             vat=c(2014,1),vat=c(1997,1))
trendvat <- zz$trend + apply(cbind(zz$dummy),1,sum)
plot.ts(trendvat)
shouhi2 <- shouhi-apply(cbind(zz$dummy),1,sum)
zz2 <- x12siml(shouhi2,sorder=2,trend=40,frequency=4,start=c(1994,1),
         rp=c(2008,3,2009,1),rp=c(2009,1,2009,4))
```

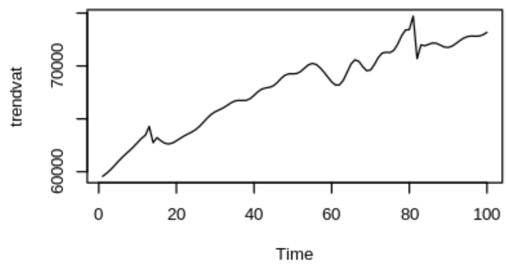
```
[1] "make mat"
     vat      vat
6481.018 1414.665
      vat       vat
```

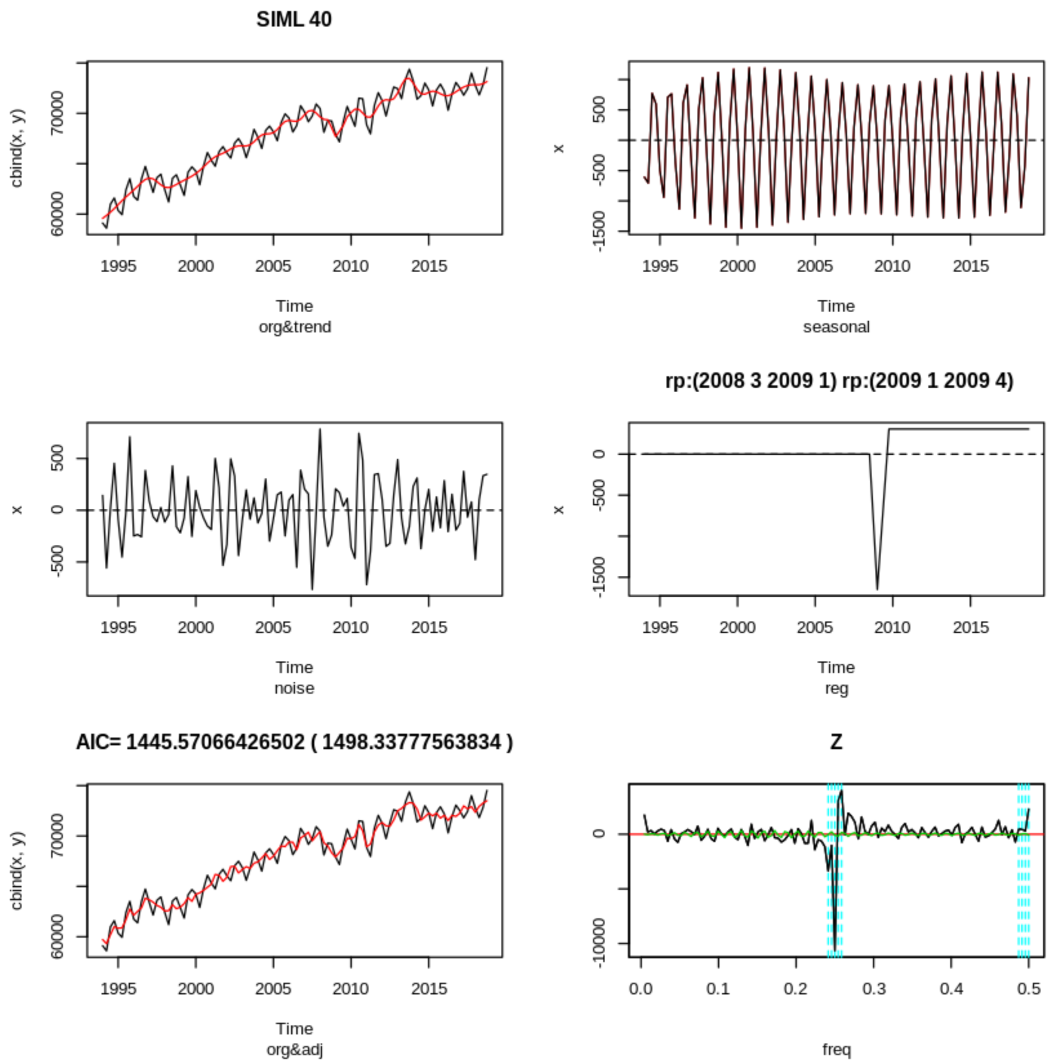
```
1707.0046  724.8809
Residual Standard Error=500.7721
R-Square=0.2517
F-statistic (df=2, 38)=6.3921
p-value=0.004

    Estimate  Std.Err t-value Pr(>|t|)
vat 6481.018 1844.716  3.5133   0.0012
vat 1414.665 1714.464  0.8251   0.4144


Residual Standard Error=639.6484
R-Square=0.2953
F-statistic (df=2, 105)=22.0051
p-value=0

     Estimate  Std.Err t-value Pr(>|t|)
vat 1707.0046 279.1154  6.1158   0.0000
vat  724.8809 282.7774  2.5634   0.0118
```




```
       rp        rp
-1649.172  1954.881
       rp        rp
-1060.731  1836.088
Residual Standard Error=508.1073
R-Square=0.1263
F-statistic (df=2, 38)=2.7471
p-value=0.0769

    Estimate   Std.Err t-value Pr(>|t|)
rp -1649.172  935.7152 -1.7625   0.0860
rp  1954.881 1009.1918  1.9371   0.0602
```

```
Residual Standard Error=627.6136
R-Square=0.0373
F-statistic (df=2, 105)=2.0327
p-value=0.1361

    Estimate   Std.Err t-value Pr(>|t|)
rp -1060.731  906.6988 -1.1699   0.2447
rp  1836.088 1103.1782  1.6644   0.0990
```

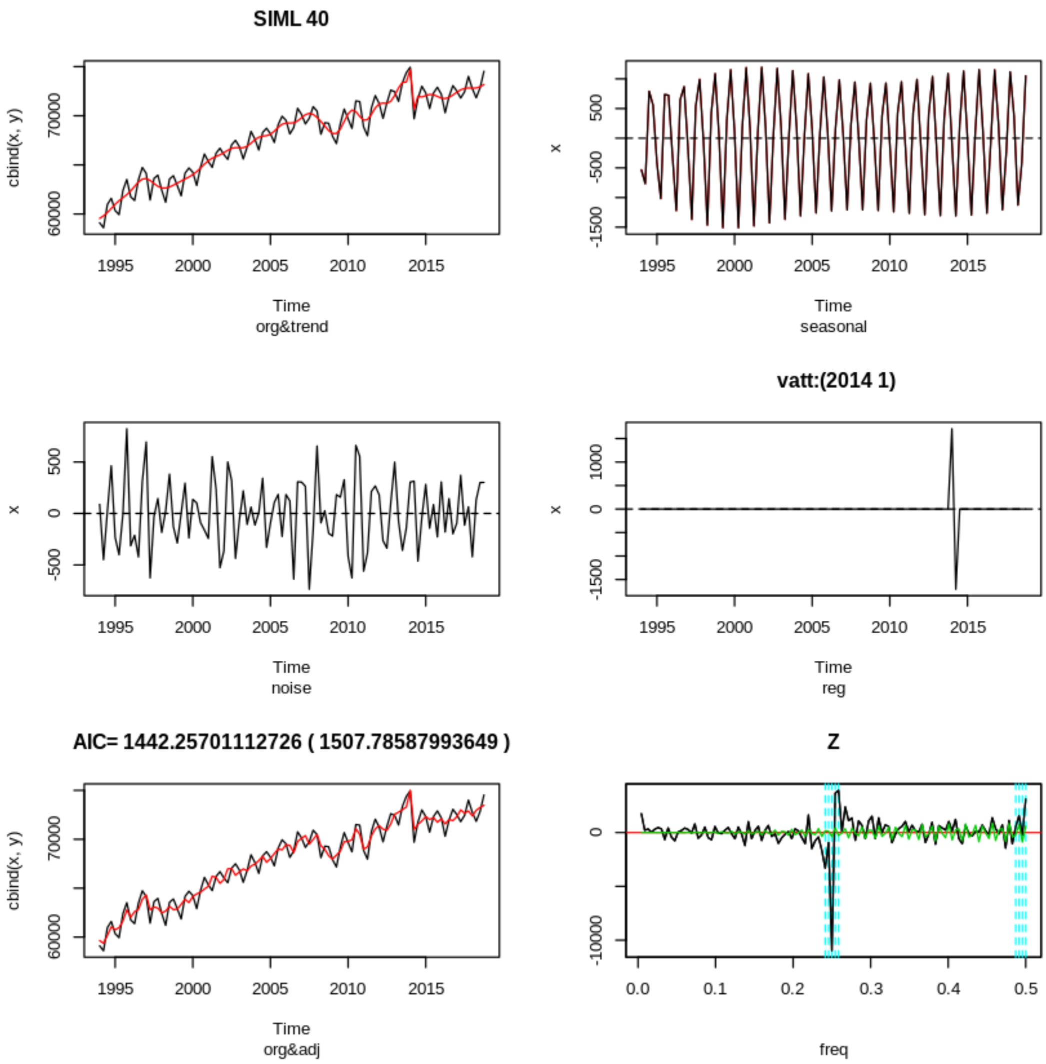




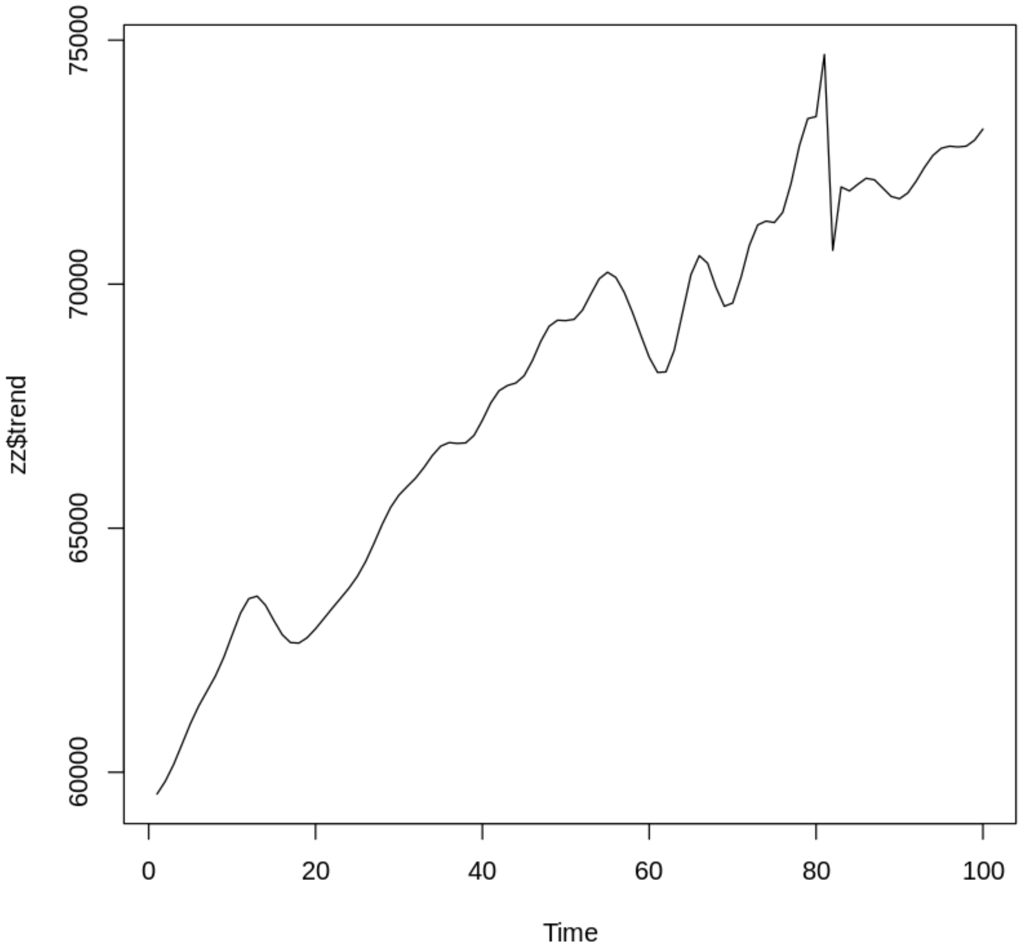
[4]:
```
#source("x12siml7m.R")
zz <- x12siml(shouhi,sorder=2,trend=40,frequency=4,start=c(1994,1),
              vatt=c(2014,1),#vatt=c(1997,1),
              # rp=c(2008,3,2009,1),rp=c(2009,1,2009,4)
              )
```

```
      X
6410.93
       X
1707.833
Residual Standard Error=498.7189
R-Square=0.2383
F-statistic (df=1, 39)=12.2032
```

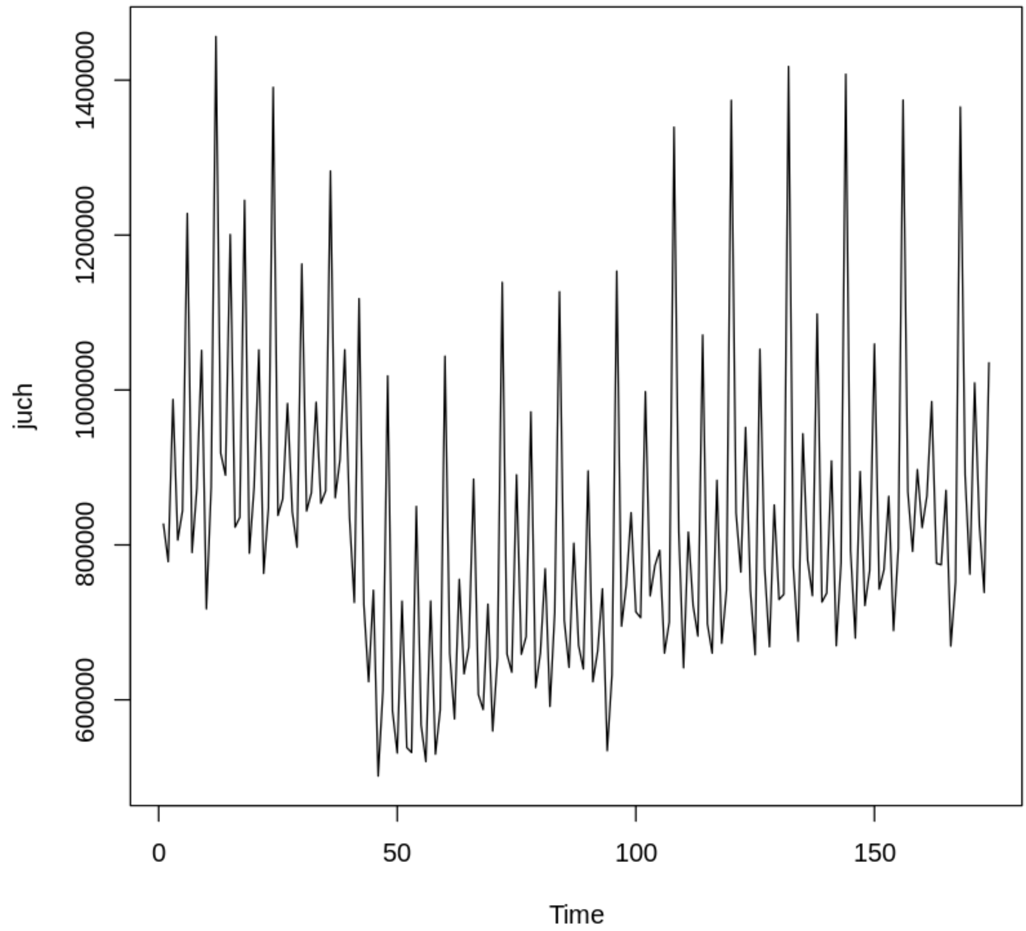
```
p-value=0.0012

  Estimate  Std.Err t-value Pr(>|t|)
X  6410.93 1835.204  3.4933   0.0012


Residual Standard Error=656.2426
R-Square=0.2513
F-statistic (df=1, 106)=35.5695
p-value=0

  Estimate  Std.Err t-value Pr(>|t|)
X 1707.833 286.3562   5.964        0
```



[5]:
```
plot.ts(zz$trend)
```



[11]:
```
juch <- read.csv("juchuuw.csv")[,1]
plot.ts(juch)
```



[12]:
```
#juch[40] <- juch[40]*1.3
zz <-␣
↪outlier(juch,tt=c(2008,1,2009,10),ilog=T,start=c(2005,4),frequency=12,trend=18,sorder=3,
```

```
[1] "make mat"
         X
-0.1299419
          X
-0.09596938
[1] "-1552.08081898594" "-943.090978293566" "2008"
[4] "1"                 "2008"              "2"
         X
-0.1522739
```

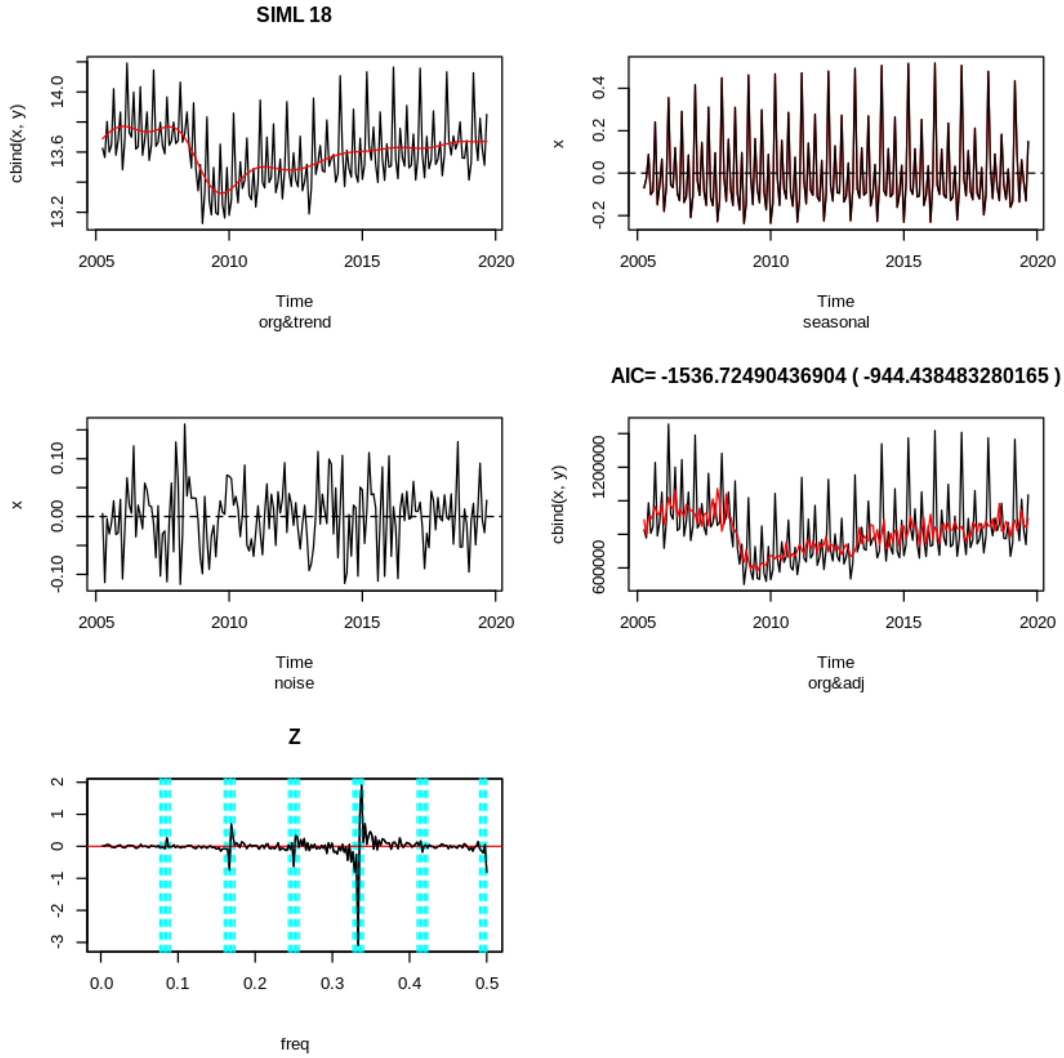
```
         X
-0.3235478
[1] "-1558.82185151989" "-946.269588459274" "2008"
[4] "1"                 "2008"              "3"
         X
-0.1751104
         X
-0.2371553
[1] "-1566.99742143887" "-943.827425459942" "2008"
[4] "1"                 "2008"              "4"
```

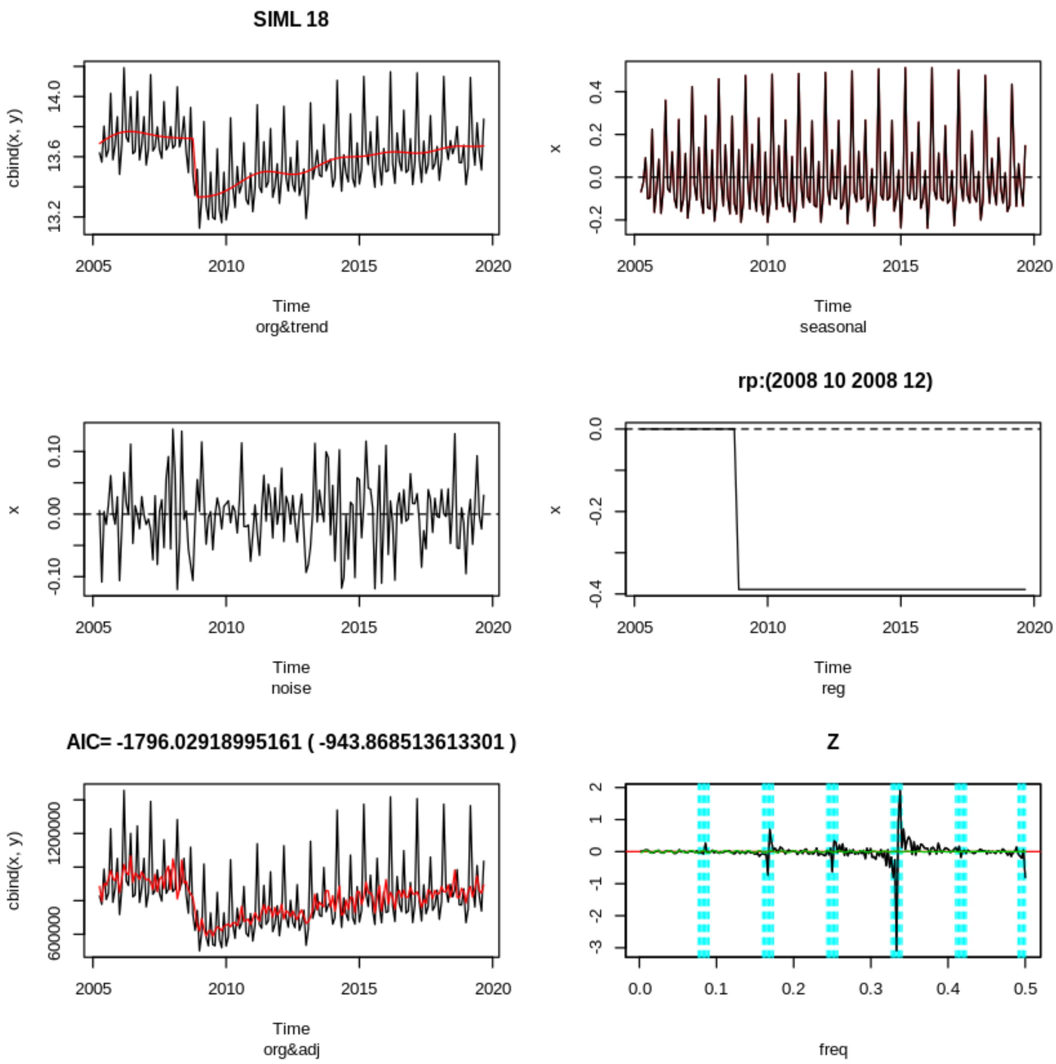
（中略）

```
         X
0.06665927
          X
-0.07261937
        X
0.1003971
          X
-0.04969224
         X
0.07624362
          X
-0.04833362
         X
0.03700928
          X
-0.02554626
         X
0.01324179
           X
-0.002374418
          X
-0.02469234
        X
-0.389145
         X
```

```
-0.1977416
Residual Standard Error=0.0179
R-Square=0.6918
F-statistic (df=1, 17)=38.1612
p-value=0

  Estimate Std.Err t-value Pr(>|t|)
X  -0.3891   0.063 -6.1775        0
```

```
Residual Standard Error=0.1186
R-Square=0.0064
F-statistic (df=1, 181)=1.1697
p-value=0.2809

  Estimate Std.Err t-value Pr(>|t|)
X  -0.1977  0.1828 -1.0815   0.2809
```


SIML 18
cbind(x, y)
Time
org&trend
x
Time
seasonal
AIC= -1536.72490436904 (-944.438483280165)
x
Time
noise
cbind(x, y)
Time
org&adj
Z
freq



[ ]:

[38]:

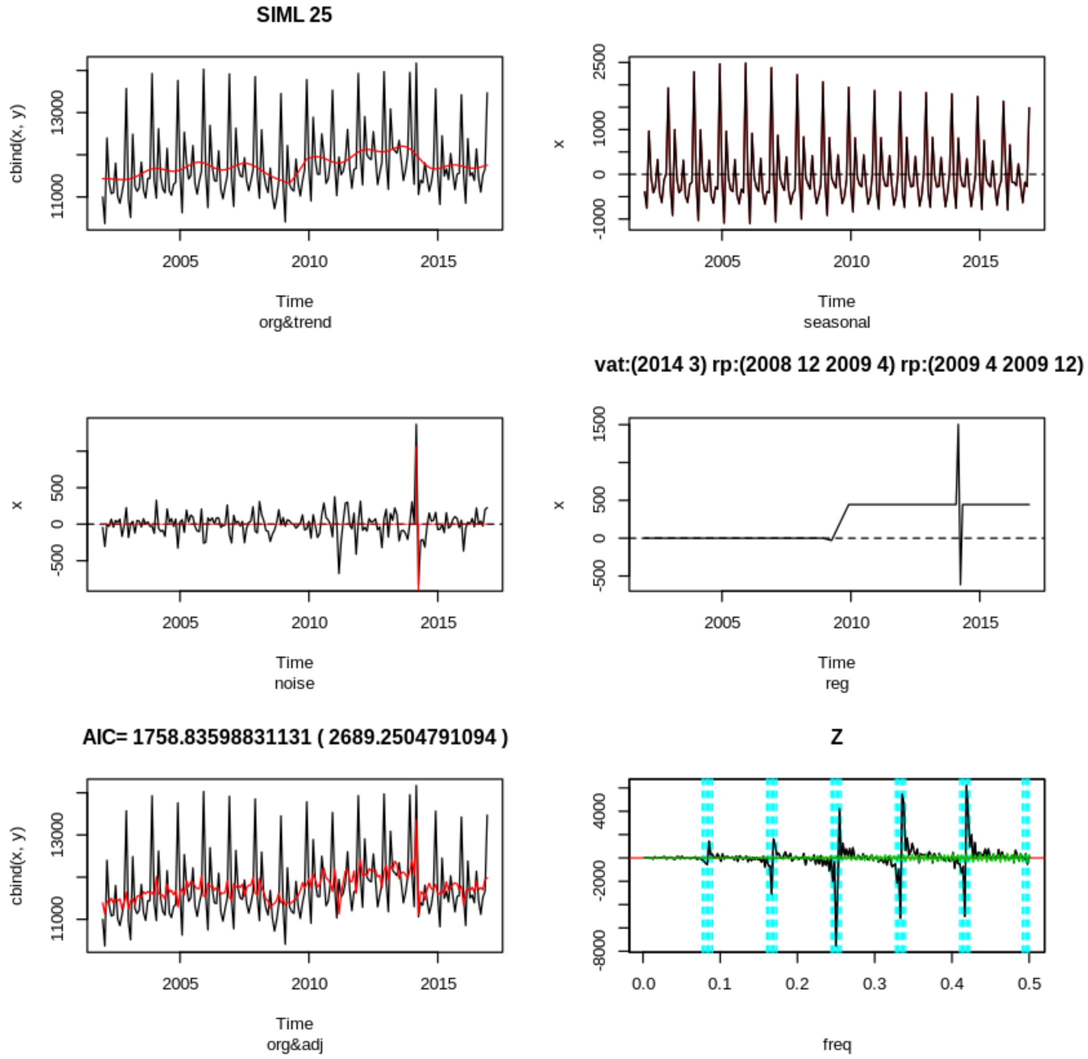
```
x <- rnorm(100)
x2 <- rnorm(100)
y <- x+rnorm(100)
lsfit(cbind(x,x2)[1:15,],y[1:15],inter=F)$coef
x[16:100] <- 0
lsfit(cbind(x,x2),y,inter=F)$coef
```

x 1.08999511636473 x2 -0.216014865209377

x 1.09077684498083 x2 -0.04949255476582

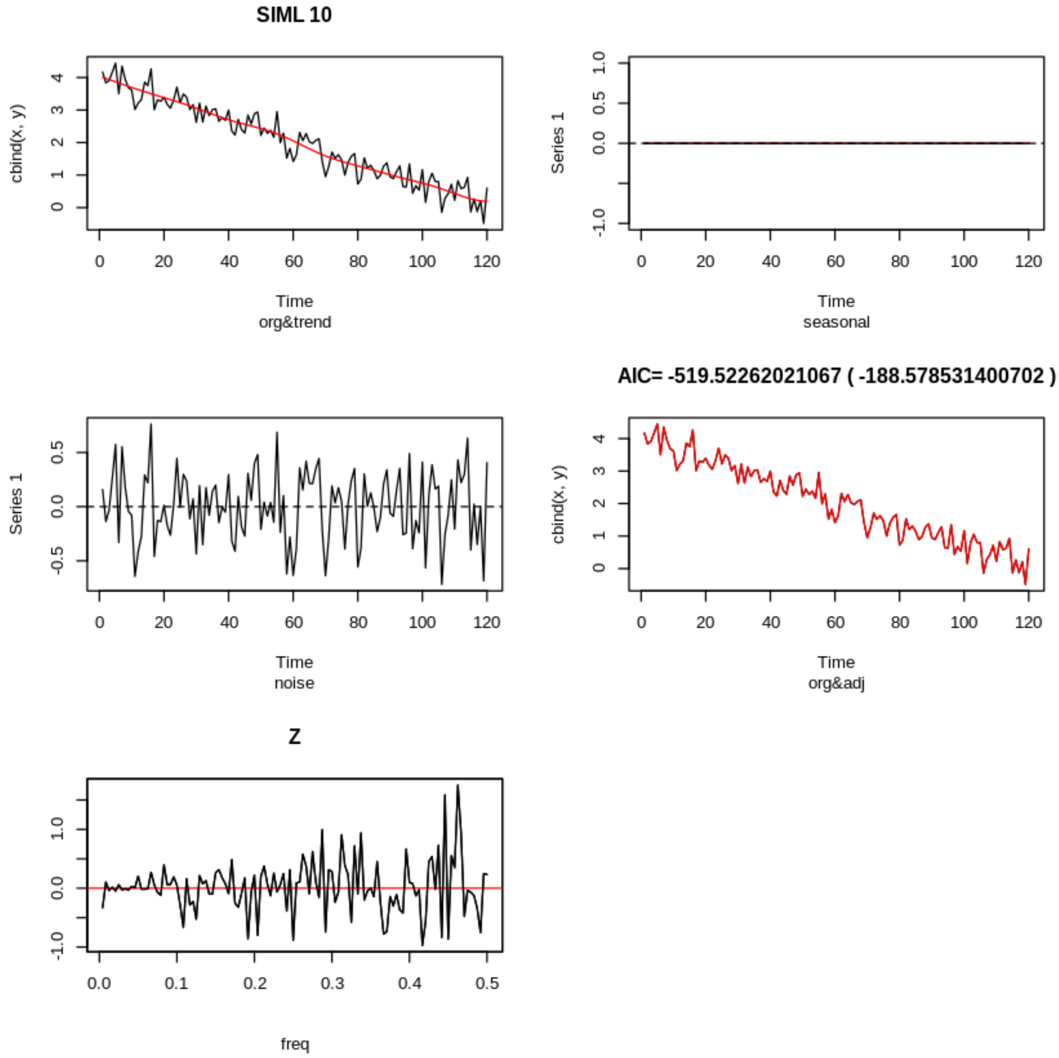
[7]:
```
zz <- x12siml(kakeim[,2],sorder=3,trend=25,frequency=12,start=c(2002,1),
              vat=c(2014,3),#vat=c(1997,1),
               rp=c(2008,12,2009,4),rp=c(2009,4,2009,12))
```

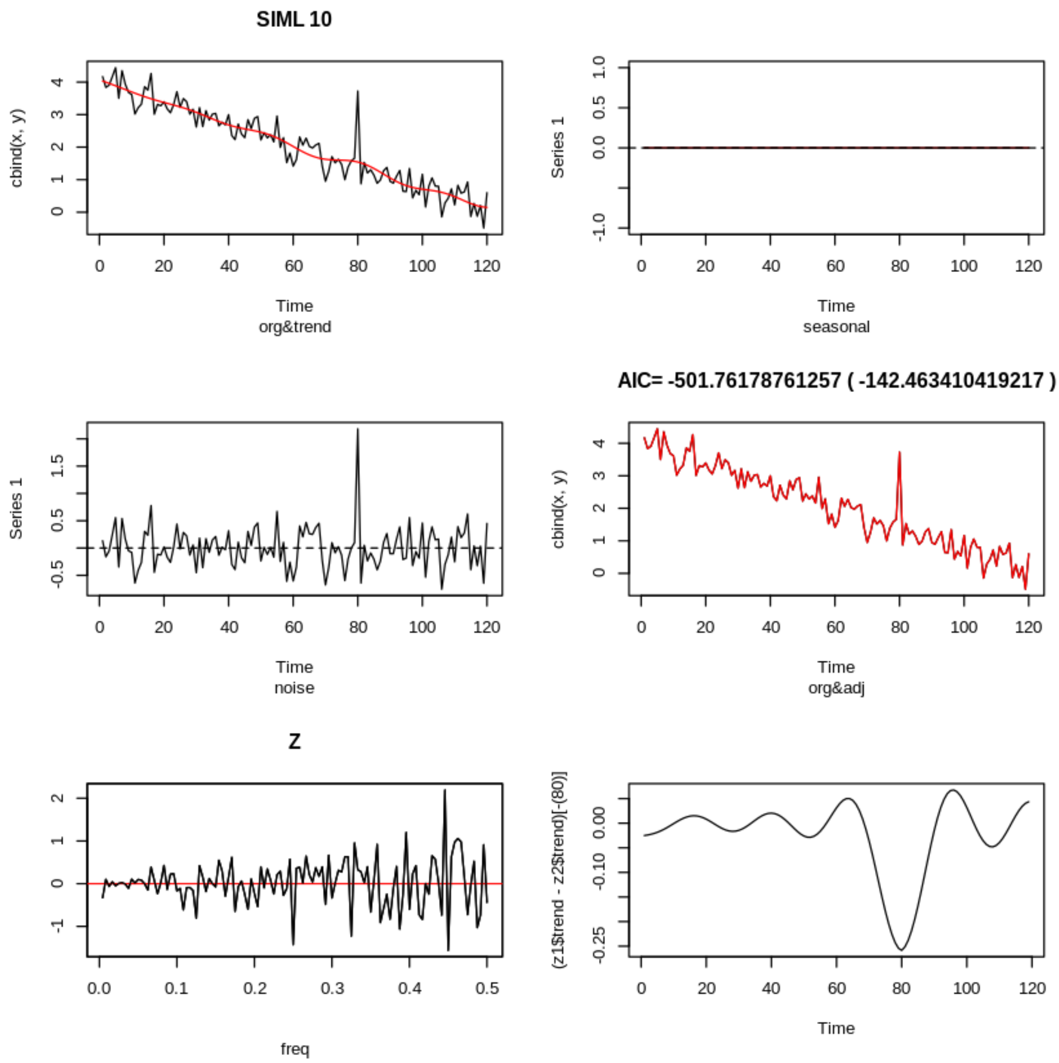
```
[1] "make mat"
       vat          rp          rp
11988.9364   -160.1981    676.9128
       vat          rp          rp
1059.58764   -30.28929   474.97769
Residual Standard Error=49.5741
R-Square=0.5755
F-statistic (df=3, 22)=9.94
p-value=2e-04

      Estimate   Std.Err t-value Pr(>|t|)
vat 11988.9364 3103.2146  3.8634   0.0008
rp   -160.1981  177.4699 -0.9027   0.3765
rp    676.9128  191.5743  3.5334   0.0019



Residual Standard Error=360.6754
R-Square=0.1838
F-statistic (df=3, 185)=13.885
p-value=0

     Estimate   Std.Err t-value Pr(>|t|)
vat 1059.5876  164.5208  6.4404   0.0000
rp   -30.2893  770.0244 -0.0393   0.9687
rp   474.9777 1055.2663  0.4501   0.6532
```



[8]:
```
y <- (120:1)/30+rnorm(120)/3
z1 <- x12siml(y,trend=10,sorder=0,start=c(1,1),frequency=1)
y[80] <- y[80]+3
#y[31] <- y[31]-3


z2 <- x12siml(y,trend=10,sorder=0,start=c(1,1),frequency=1) #,aot=c(80,1))
plot.ts((z1$trend-z2$trend)[-(80)])
```

```
[1] "make mat"
```


SIML 10
cbind(x, y)
Time
org&trend
Series 1
Time
seasonal
AIC= -519.52262021067 (-188.578531400702)
Series 1
Time
noise
cbind(x, y)
Time
org&adj
Z
freq

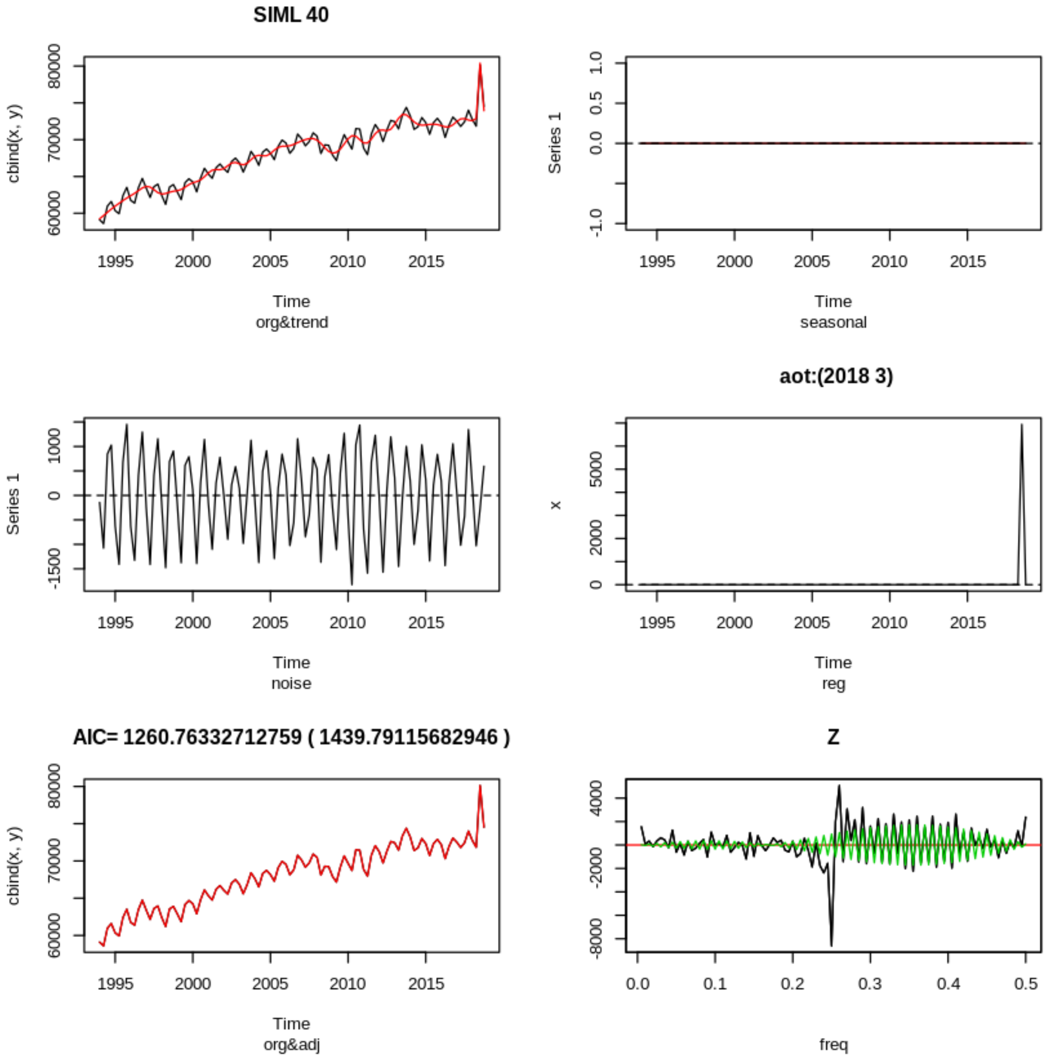


[9]:
```
shouhi3 <- shouhi2
shouhi3[99] <- shouhi3[99]*1.1

# Without seasonals, regress all Z
%(季節性をなしにして、Z全体に回帰させる場合)



zz2 <- x12siml(shouhi3,sorder=0,trend=40,frequency=4,start=c(1994,1) ,
   #       rp=c(2008,3,2009,1),rp=c(2009,1,2009,4),
              aot=c(2018,3)
              )
shouhi3[80]-shouhi2[80]
```

```
# The estimated value may be larger than the actual outlier.
(abouut 1000.)
%(実際の異常値よりも大きい値が推定されてしまう。（１０００ぐらい大きい））
```

```
[1] "make mat"
       X
9033.126
       X
6943.179
Residual Standard Error=542.656
R-Square=0.2676
F-statistic (df=1, 39)=14.2473
p-value=5e-04

  Estimate  Std.Err t-value Pr(>|t|)
X 9033.126 2393.157  3.7746    5e-04



Residual Standard Error=1318.145
R-Square=0.3592
F-statistic (df=1, 99)=55.4909
p-value=0

  Estimate  Std.Err t-value Pr(>|t|)
X 6943.179 932.0679  7.4492        0
```

0

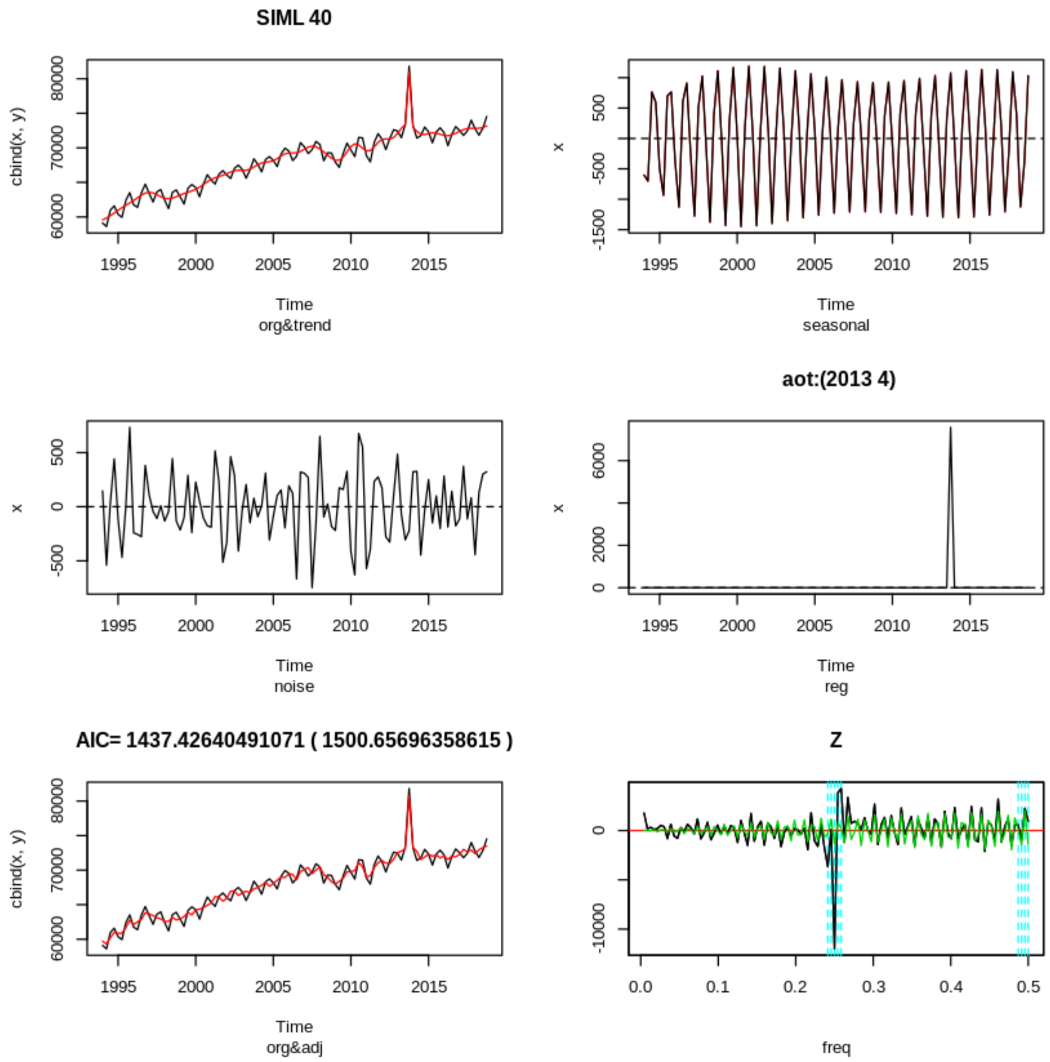


[10]:

```
shouhi3 <- shouhi2
shouhi3[80] <- shouhi3[80]*1.1
zz2 <- x12siml(shouhi3,sorder=2,trend=40,frequency=4,start=c(1994,1) ,
    #     rp=c(2008,3,2009,1),rp=c(2009,1,2009,4),
              aot=c(2013,4)
              )
#  Assuming seasonals and regress except the seasonal
frequency bonds, we can estimate the true value.
%(季節性を仮定して、季節周波数以外で回帰すると、正しい値を推定することができる。)
```

```
[1] "make mat"
       X
```

```
11454.64
       X
7572.638
Residual Standard Error=488.4421
R-Square=0.6272
F-statistic (df=1, 39)=65.6134
p-value=0

  Estimate  Std.Err t-value Pr(>|t|)
X 11454.64 1414.116  8.1002        0


Residual Standard Error=636.3842
R-Square=0.7052
F-statistic (df=1, 106)=253.5785
p-value=0

  Estimate  Std.Err t-value Pr(>|t|)
X 7572.638 475.5443 15.9241        0
```


SIML 40
cbind(x, y)
Time
org&trend
x
Time
seasonal
x
Time
noise
aot:(2013 4)
x
Time
reg
AIC= 1437.42640491071 (1500.65696358615)
cbind(x, y)
Time
org&adj
Z
freq

[ ]: