```
R version 4.3.1 (2023-06-16 ucrt) -- "Beagle Scouts"
Copyright (C) 2023 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

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Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> install.packages("readxl")
Installing package into ‘C:/Users/minhas01/AppData/Local/R/win-library/4.3’
(as ‘lib’ is unspecified)
--- Please select a CRAN mirror for use in this session ---
trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/readxl_1.4.3.zip'
Content type 'application/zip' length 1197261 bytes (1.1 MB)
downloaded 1.1 MB

package ‘readxl’ successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\minhas01\AppData\Local\Temp\RtmpGAggMH\downloaded_packages
> install.packages("seasonal")
Installing package into ‘C:/Users/minhas01/AppData/Local/R/win-library/4.3’
(as ‘lib’ is unspecified)
trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/seasonal_1.9.0.zip'
Content type 'application/zip' length 549590 bytes (536 KB)
downloaded 536 KB

package ‘seasonal’ successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\minhas01\AppData\Local\Temp\RtmpGAggMH\downloaded_packages
> library(readxl)
Warning message:
package ‘readxl’ was built under R version 4.3.3
> library(seasonal)
Warning message:
package ‘seasonal’ was built under R version 4.3.3
> data <- read.csv("C:Users/minhas01/Desktop/Nahayan Minhas/US Net Capital Mthly Inflows Level Ch
anged Qrtly.csv")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") :
  cannot open file 'C:Users/minhas01/Desktop/Nahayan Minhas/US Net Capital Mthly Inflows Level Ch
anged Qrtly.csv': No such file or directory
> data <- read.csv("C:Users/minhas01/Desktop/Nahayan Minhas/US Net Capital Mthly Inflows Level Ch
anged Qrtly.csv")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") :
  cannot open file 'C:Users/minhas01/Desktop/Nahayan Minhas/US Net Capital Mthly Inflows Level Ch
anged Qrtly.csv': No such file or directory
> data <- read.csv("C:Users/minhas01/Desktop/Nahayan Minhas/Data for R Analysis/US Net Capital Mt
hly Inflows Level Changed Qrtly.csv")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") :
  cannot open file 'C:Users/minhas01/Desktop/Nahayan Minhas/Data for R Analysis/US Net Capital Mt
hly Inflows Level Changed Qrtly.csv': No such file or directory
> data <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/Data for R Analysis/US Net Capital M
```

```
thly Inflows Level Changed Qrtly.csv")
Error: bidi formatting not allowed, use escapes instead (\u202a) (<input>:1:19)
> data <- read.csv("C:/Users/minhas01/Desktop/USDebt.csv")
> data$Date <- sub("^00(\\d{2})", "19\\1", data$Date)
> head(data$Date)
[1] "3/31/1994"  "6/30/1994"  "9/30/1994"  "12/31/1994" "3/31/1995"  "6/30/1995"
> data$Date <- as.Date(data$Date, format="%m/%d/%Y")
> head(data$Date)
[1] "1994-03-31" "1994-06-30" "1994-09-30" "1994-12-31" "1995-03-31" "1995-06-30"
> if (!any(is.na(data$Date))) {
+   data$Year <- as.numeric(format(data$Date, "%Y"))
+   data$Quarter <- ceiling(as.numeric(format(data$Date, "%m")) / 3)
+ head(data$Year)
+   head(data$Quarter)
+ } else {
+   print("There was an error converting the dates.")
+ }
[1] 1 2 3 4 1 2
> ts_data <- ts(data$Value, frequency=4, start=c(min(data$Year), min(data$Quarter)))
Error in ts(data$Value, frequency = 4, start = c(min(data$Year), min(data$Quarter))) :
  'ts' object must have one or more observations
>  data <- read.csv("C:/Users/minhas01/Desktop/USDebt.csv")
>  data$Date <- sub("^00(\\d{2})", "19\\1", data$Date)
>  head(data$Date)
[1] "3/31/1994"  "6/30/1994"  "9/30/1994"  "12/31/1994" "3/31/1995"  "6/30/1995"
> data$Date <- as.Date(data$Date, format="%m/%d/%Y")
>  head(data$Date)
[1] "1994-03-31" "1994-06-30" "1994-09-30" "1994-12-31" "1995-03-31" "1995-06-30"
>  if (!any(is.na(data$Date))) {
+ +   data$Year <- as.numeric(format(data$Date, "%Y"))
+ +   data$Quarter <- ceiling(as.numeric(format(data$Date, "%m")) / 3)
+ + head(data$Year)
+ +   head(data$Quarter)
+ + } else {
Error: unexpected '}' in:
"+   head(data$Quarter)
+ }"
> +   print("There was an error converting the dates.")
[1] "There was an error converting the dates."
Error in +print("There was an error converting the dates.") :
  invalid argument to unary operator
> + }
Error: unexpected '}' in "+ }"
> if (!any(is.na(data$Date))) {
+   data$Year <- as.numeric(format(data$Date, "%Y"))
+   data$Quarter <- ceiling(as.numeric(format(data$Date, "%m")) / 3)
+ head(data$Year)
+   head(data$Quarter)
+ } else {
+   print("There was an error converting the dates.")
+ }
[1] 1 2 3 4 1 2
> ts_data <- ts(data$Value, frequency=4, start=c(min(data$Year), min(data$Quarter)))
> sa_results <- seas(ts_data)
Model used in SEATS is different: (0 0 0)
> adjusted <- final(sa_results)
> plot(ts_data, main = "Original vs. Seasonally Adjusted", col = "blue", ylab="Value", xlab="Time
")
> lines(adjusted, col = "red")
> legend("topright", legend = c("Original", "Adjusted"), col = c("blue", "red"), lty = 1, bty = "
n")
Error in (function (s, units = "user", cex = NULL, font = NULL, vfont = NULL,  :
  plot.new has not been called yet

> > data <- read.csv("C:/Users/minhas01/Desktop/USDXY.csv")
> data$Date <- sub("^00(\\d{2})", "19\\1", data$Date)
>  head(data$Date)
[1] "3/31/1994"  "6/30/1994"  "9/30/1994"  "12/30/1994" "3/31/1995"  "9/29/1995"
>  data$Date <- as.Date(data$Date, format="%m/%d/%Y")
>
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> data$Date <- as.Date(data$Date, format="%m/%d/%Y")
> head(data$Date)
[1] "1994-03-31" "1994-06-30" "1994-09-30" "1994-12-30" "1995-03-31" "1995-09-29"
> if (!any(is.na(data$Date))) {
+   data$Year <- as.numeric(format(data$Date, "%Y"))
+   data$Quarter <- ceiling(as.numeric(format(data$Date, "%m")) / 3)
+ head(data$Year)
+   head(data$Quarter)
+ } else {
+   print("There was an error converting the dates.")
+ }
[1] 1 2 3 4 1 3
> ts_data <- ts(data$Value, frequency=4, start=c(min(data$Year), min(data$Quarter)))
> sa_results <- seas(ts_data)
Model used in SEATS is different: (0 0 0)
> summary(sa_results)

Call:
seas(x = ts_data)

Coefficients:
                  Estimate Std. Error z value Pr(>|z|)
MA-Nonseasonal-01 -0.34150    0.08656  -3.945 7.97e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

SEATS adj.  ARIMA: (0 0 1)  Obs.: 119  Transform: none
AICc: 681.8, BIC: 687.3  QS (no seasonality in final):    0
Box-Ljung (no autocorr.): 17.08   Shapiro (normality): 0.9864
Messages generated by X-13:
Warnings:
- Automatic transformation selection cannot be done on a series with zero or negative values.

Notes:
- Model used for SEATS decomposition is different from the model estimated in the regARIMA modeli
ng module of X-13ARIMA-SEATS.

> install.packages("vars")
Installing package into ‘C:/Users/minhas01/AppData/Local/R/win-library/4.3’
(as ‘lib’ is unspecified)
also installing the dependencies ‘zoo’, ‘strucchange’, ‘urca’, ‘lmtest’, ‘sandwich’

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/zoo_1.8-12.zip'
Content type 'application/zip' length 1020531 bytes (996 KB)
downloaded 996 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/strucchange_1.5-3.zip'
Content type 'application/zip' length 947106 bytes (924 KB)
downloaded 924 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/urca_1.3-3.zip'
Content type 'application/zip' length 1109075 bytes (1.1 MB)
downloaded 1.1 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/lmtest_0.9-40.zip'
Content type 'application/zip' length 405925 bytes (396 KB)
downloaded 396 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/sandwich_3.1-0.zip'
Content type 'application/zip' length 1508756 bytes (1.4 MB)
downloaded 1.4 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/vars_1.6-1.zip'
Content type 'application/zip' length 425536 bytes (415 KB)
downloaded 415 KB

package ‘zoo’ successfully unpacked and MD5 sums checked
package ‘strucchange’ successfully unpacked and MD5 sums checked
package ‘urca’ successfully unpacked and MD5 sums checked
package ‘lmtest’ successfully unpacked and MD5 sums checked
```

```
package ‘sandwich’ successfully unpacked and MD5 sums checked
package ‘vars’ successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\minhas01\AppData\Local\Temp\RtmpGAggMH\downloaded_packages
> install.packages("readr")
Installing package into ‘C:/Users/minhas01/AppData/Local/R/win-library/4.3’
(as ‘lib’ is unspecified)
also installing the dependencies ‘bit’, ‘bit64’, ‘tidyselect’, ‘withr’, ‘clipr’, ‘vroom’, ‘tzdb’

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/bit_4.0.5.zip'
Content type 'application/zip' length 1136720 bytes (1.1 MB)
downloaded 1.1 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/bit64_4.0.5.zip'
Content type 'application/zip' length 494921 bytes (483 KB)
downloaded 483 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/tidyselect_1.2.1.zip'
Content type 'application/zip' length 225188 bytes (219 KB)
downloaded 219 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/withr_3.0.0.zip'
Content type 'application/zip' length 246001 bytes (240 KB)
downloaded 240 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/clipr_0.8.0.zip'
Content type 'application/zip' length 54687 bytes (53 KB)
downloaded 53 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/vroom_1.6.5.zip'
Content type 'application/zip' length 1331241 bytes (1.3 MB)
downloaded 1.3 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/tzdb_0.4.0.zip'
Content type 'application/zip' length 1032572 bytes (1008 KB)
downloaded 1008 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/readr_2.1.5.zip'
Content type 'application/zip' length 1172532 bytes (1.1 MB)
downloaded 1.1 MB

package ‘bit’ successfully unpacked and MD5 sums checked
package ‘bit64’ successfully unpacked and MD5 sums checked
package ‘tidyselect’ successfully unpacked and MD5 sums checked
package ‘withr’ successfully unpacked and MD5 sums checked
package ‘clipr’ successfully unpacked and MD5 sums checked
package ‘vroom’ successfully unpacked and MD5 sums checked
package ‘tzdb’ successfully unpacked and MD5 sums checked
package ‘readr’ successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\minhas01\AppData\Local\Temp\RtmpGAggMH\downloaded_packages
> library(vars)
Loading required package: MASS
Loading required package: strucchange
Loading required package: zoo

Attaching package: ‘zoo’

The following objects are masked from ‘package:base’:

    as.Date, as.Date.numeric

Loading required package: sandwich
Loading required package: urca
Loading required package: lmtest
Warning messages:
1: package ‘vars’ was built under R version 4.3.3
2: package ‘strucchange’ was built under R version 4.3.3
```

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3: package ‘zoo’ was built under R version 4.3.3
4: package ‘sandwich’ was built under R version 4.3.3
5: package ‘urca’ was built under R version 4.3.3
6: package ‘lmtest’ was built under R version 4.3.3
> library(readr)
Warning message:
package ‘readr’ was built under R version 4.3.3
> var1 <- read_csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
[1mindexing[0m [34m3M TBill SA.csv[0m [=================================================
================================================================================================
==========================] [32m45.66MB/s[0m, eta: [36m 0s[0m


                                  Rows: 120 Columns: 2
── Column specification ────────────────────────────────────────────────────────────────────────
────────────────────────────────────────────────────────────────────────────────────────────────
Delimiter: ","
chr (1): Date
dbl (1): Value

ℹ Use `spec()` to retrieve the full column specification for this data.
ℹ Specify the column types or set `show_col_types = FALSE` to quiet this message.
> var1 <- read_csv("path_to_your_file.csv",
+                  col_types = cols(
+                    Date = col_date(format = "%m/%d/%Y"),
+                    Value = col_double()
+
+
+
+
+
+
+

+ > AAAAA
Error: object 'AAAAA' not found
> library(vars)
>
> library(readr)
>
> data1 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> data2 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US CPI SA.csv")
> data3 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US IP SA.csv")
> data4 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US Unemployment SA.csv")
> data5 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/USDebt SA.csv")
> data6 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/USDXY SA.csv")
> data1$Date <- as.Date(data1$Date, format="%m/%d/%Y")
> data2$Date <- as.Date(data2$Date, format="%m/%d/%Y")
> data3$Date <- as.Date(data3$Date, format="%m/%d/%Y")
> data4$Date <- as.Date(data4$Date, format="%m/%d/%Y")
> data5$Date <- as.Date(data5$Date, format="%m/%d/%Y")
> data6$Date <- as.Date(data6$Date, format="%m/%d/%Y")
> anyNA(data1$Date)
[1] FALSE
> anyNA(data2$Date)
[1] FALSE
> anyNA(data3$Date)
[1] FALSE
> anyNA(data4$Date)
[1] FALSE
> anyNA(data5$Date)
[1] FALSE
> anyNA(data6$Date)
[1] FALSE
> ts1 <- ts(data1[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
Error in year(min(data1$Date)) : could not find function "year"
> install.packages("lubridate")
Installing package into ‘C:/Users/minhas01/AppData/Local/R/win-library/4.3’
(as ‘lib’ is unspecified)
```

```
also installing the dependencies ‘generics’, ‘timechange’

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/generics_0.1.3.zip'
Content type 'application/zip' length 80415 bytes (78 KB)
downloaded 78 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/timechange_0.3.0.zip'
Content type 'application/zip' length 507755 bytes (495 KB)
downloaded 495 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/lubridate_1.9.3.zip'
Content type 'application/zip' length 984899 bytes (961 KB)
downloaded 961 KB

package ‘generics’ successfully unpacked and MD5 sums checked
package ‘timechange’ successfully unpacked and MD5 sums checked
package ‘lubridate’ successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\minhas01\AppData\Local\Temp\RtmpGAggMH\downloaded_packages
> library(lubridate)

Attaching package: ‘lubridate’

The following objects are masked from ‘package:base’:

    date, intersect, setdiff, union

Warning message:
package ‘lubridate’ was built under R version 4.3.3
> ts1 <- ts(data1[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
> ts2 <- ts(data2[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
> ts3 <- ts(data3[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
> ts4 <- ts(data4[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
> ts5 <- ts(data5[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
> ts6 <- ts(data6[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
> mts_data <- cbind(ts1, ts2, ts3, ts4, ts5, ts6)
> var_model <- VAR(mts_data, p=8)
Error in VAR(mts_data, p = 8) :
NAs in y.
> data1 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> > data2 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US CPI SA.csv")
Error: unexpected '>' in ">"
> > data3 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US IP SA.csv")
Error: unexpected '>' in ">"
> > data4 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US Unemployment SA.csv")
Error: unexpected '>' in ">"
> > data5 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/USDebt SA.csv")
Error: unexpected '>' in ">"
> > data6 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/USDXY SA.csv")
Error: unexpected '>' in ">"
> > data1$Date <- as.Date(data1$Date, format="%m/%d/%Y")
Error: unexpected '>' in ">"
> > data2$Date <- as.Date(data2$Date, format="%m/%d/%Y")
Error: unexpected '>' in ">"
> > data3$Date <- as.Date(data3$Date, format="%m/%d/%Y")
Error: unexpected '>' in ">"
> > data4$Date <- as.Date(data4$Date, format="%m/%d/%Y")
Error: unexpected '>' in ">"
> > data5$Date <- as.Date(data5$Date, format="%m/%d/%Y")
Error: unexpected '>' in ">"
> > data6$Date <- as.Date(data6$Date, format="%m/%d/%Y")
Error: unexpected '>' in ">"
> data2 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> data3 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> data4 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> data5 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> data6 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> ts1 <- ts(data1[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
Error in as.POSIXlt.character(x, tz = tz(x)) :
```

```
  character string is not in a standard unambiguous format
> ts1 <- ts(data1[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
Error in as.POSIXlt.character(x, tz = tz(x)) :
  character string is not in a standard unambiguous format
> library(lubridate)
> ts1 <- ts(data1[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
Error in as.POSIXlt.character(x, tz = tz(x)) :
  character string is not in a standard unambiguous format
> data1 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> ts1 <- ts(data1[,2], start=c(year(min(data1$Date)), month(min(data1$Date))), frequency=4)
Error in as.POSIXlt.character(x, tz = tz(x)) :
  character string is not in a standard unambiguous format
> data1$Date <- as.Date(data1$Date, format="%m/%d/%Y")
> str(data1$Date)
 Date[1:120], format: "1994-03-31" "1994-06-30" "1994-09-30" "1994-12-31" "1995-03-31" "1995-06-3
0" "1995-09-30" "1995-12-31" "1996-03-31" "1996-06-30" "1996-09-30" "1996-12-31" "1997-03-31" "19
97-06-30" "1997-09-30" "1997-12-31" ...
> start_year <- year(min(data1$Date))
> start_month <- month(min(data1$Date))
> print(start_year)
[1] 1994
> print(start_month)
[1] 3
> ts1 <- ts(data1[,2], start=c(start_year, start_month), frequency=4)
> ts2 <- ts(data1[,2], start=c(start_year, start_month), frequency=4)
> ts2 <- ts(data2[,2], start=c(start_year, start_month), frequency=4)
> ts1 <- ts(data1[,2], start=c(start_year, start_month), frequency=4)
> ts3 <- ts(data3[,2], start=c(start_year, start_month), frequency=4)
> ts4 <- ts(data4[,2], start=c(start_year, start_month), frequency=4)
> ts5 <- ts(data5[,2], start=c(start_year, start_month), frequency=4)
> ts6 <- ts(data6[,2], start=c(start_year, start_month), frequency=4)
> anyNA(data1$Date)
[1] FALSE
> anyNA(data2$Date)
[1] FALSE
> anyNA(data3$Date)
[1] FALSE
> anyNA(data4$Date)
[1] FALSE
> anyNA(data5$Date)
[1] FALSE
> anyNA(data6$Date)
[1] FALSE
> mts_data <- cbind(ts1, ts2, ts3, ts4, ts5, ts6)
> var_model <- VAR(mts_data, p=8)
> summary(var_model)
Error in solve.default(Sigma) :
  Lapack routine dgesv: system is exactly singular: U[2,2] = 0
> apply(data1[, -1], 2, var)
Error in apply(data1[, -1], 2, var) : dim(X) must have a positive length
> apply(data1[, -1, drop = FALSE], 2, var)
    Value
0.2255839
> apply(data2[, -1, drop = FALSE], 2, var)
    Value
0.2255839
> apply(data3[, -1, drop = FALSE], 2, var)
    Value
0.2255839
> apply(data4[, -1, drop = FALSE], 2, var)
    Value
0.2255839
> apply(data5[, -1, drop = FALSE], 2, var)
    Value
0.2255839
> apply(data6[, -1, drop = FALSE], 2, var)
    Value
0.2255839
> install.packages("car")
Installing package into ‘C:/Users/minhas01/AppData/Local/R/win-library/4.3’
```

```
(as 'lib' is unspecified)
also installing the dependencies 'fs', 'pkgbuild', 'rprojroot', 'diffobj', 'rematch2', 'stringi',
 'brio', 'callr', 'desc', 'digest', 'evaluate', 'jsonlite', 'pkgload', 'praise', 'processx', 'ps'
, 'waldo', 'backports', 'ellipsis', 'purrr', 'stringr', 'tidyr', 'Matrix', 'testthat', 'colorspac
e', 'broom', 'dplyr', 'numDeriv', 'SparseM', 'MatrixModels', 'minqa', 'nloptr', 'Rcpp', 'RcppEige
n', 'farver', 'labeling', 'munsell', 'RColorBrewer', 'viridisLite', 'carData', 'abind', 'pbkrtest
', 'quantreg', 'lme4', 'scales'


  There is a binary version available but the source version is later:
         binary  source needs_compilation
testthat  3.2.1 3.2.1.1              TRUE

  Binaries will be installed
trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/fs_1.6.3.zip'
Content type 'application/zip' length 393952 bytes (384 KB)
downloaded 384 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/pkgbuild_1.4.4.zip'
Content type 'application/zip' length 202485 bytes (197 KB)
downloaded 197 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/rprojroot_2.0.4.zip'
Content type 'application/zip' length 113611 bytes (110 KB)
downloaded 110 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/diffobj_0.3.5.zip'
Content type 'application/zip' length 1006897 bytes (983 KB)
downloaded 983 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/rematch2_2.1.2.zip'
Content type 'application/zip' length 47517 bytes (46 KB)
downloaded 46 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/stringi_1.8.3.zip'
Content type 'application/zip' length 14998651 bytes (14.3 MB)
downloaded 14.3 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/brio_1.1.4.zip'
Content type 'application/zip' length 40388 bytes (39 KB)
downloaded 39 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/callr_3.7.6.zip'
Content type 'application/zip' length 460456 bytes (449 KB)
downloaded 449 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/desc_1.4.3.zip'
Content type 'application/zip' length 329808 bytes (322 KB)
downloaded 322 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/digest_0.6.35.zip'
Content type 'application/zip' length 217636 bytes (212 KB)
downloaded 212 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/evaluate_0.23.zip'
Content type 'application/zip' length 84130 bytes (82 KB)
downloaded 82 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/jsonlite_1.8.8.zip'
Content type 'application/zip' length 1105680 bytes (1.1 MB)
downloaded 1.1 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/pkgload_1.3.4.zip'
Content type 'application/zip' length 179711 bytes (175 KB)
downloaded 175 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/praise_1.0.0.zip'
Content type 'application/zip' length 19864 bytes (19 KB)
downloaded 19 KB
```

```
trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/processx_3.8.4.zip'
Content type 'application/zip' length 686717 bytes (670 KB)
downloaded 670 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/ps_1.7.6.zip'
Content type 'application/zip' length 553130 bytes (540 KB)
downloaded 540 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/waldo_0.5.2.zip'
Content type 'application/zip' length 105112 bytes (102 KB)
downloaded 102 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/backports_1.4.1.zip'
Content type 'application/zip' length 101330 bytes (98 KB)
downloaded 98 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/ellipsis_0.3.2.zip'
Content type 'application/zip' length 40504 bytes (39 KB)
downloaded 39 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/purrr_1.0.2.zip'
Content type 'application/zip' length 499240 bytes (487 KB)
downloaded 487 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/stringr_1.5.1.zip'
Content type 'application/zip' length 319042 bytes (311 KB)
downloaded 311 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/tidyr_1.3.1.zip'
Content type 'application/zip' length 1267041 bytes (1.2 MB)
downloaded 1.2 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/Matrix_1.6-5.zip'
Content type 'application/zip' length 4556853 bytes (4.3 MB)
downloaded 4.3 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/testthat_3.2.1.zip'
Content type 'application/zip' length 2222964 bytes (2.1 MB)
downloaded 2.1 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/colorspace_2.1-0.zip'
Content type 'application/zip' length 2629637 bytes (2.5 MB)
downloaded 2.5 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/broom_1.0.5.zip'
Content type 'application/zip' length 1862685 bytes (1.8 MB)
downloaded 1.8 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/dplyr_1.1.4.zip'
Content type 'application/zip' length 1560172 bytes (1.5 MB)
downloaded 1.5 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/numDeriv_2016.8-1.1.zip'
Content type 'application/zip' length 116116 bytes (113 KB)
downloaded 113 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/SparseM_1.81.zip'
Content type 'application/zip' length 1042203 bytes (1017 KB)
downloaded 1017 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/MatrixModels_0.5-3.zip'
Content type 'application/zip' length 414375 bytes (404 KB)
downloaded 404 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/minqa_1.2.6.zip'
Content type 'application/zip' length 459251 bytes (448 KB)
downloaded 448 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/nloptr_2.0.3.zip'
Content type 'application/zip' length 1011763 bytes (988 KB)
```

```
downloaded 988 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/Rcpp_1.0.12.zip'
Content type 'application/zip' length 2877947 bytes (2.7 MB)
downloaded 2.7 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/RcppEigen_0.3.4.0.0.zip'
Content type 'application/zip' length 2611015 bytes (2.5 MB)
downloaded 2.5 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/farver_2.1.1.zip'
Content type 'application/zip' length 1505868 bytes (1.4 MB)
downloaded 1.4 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/labeling_0.4.3.zip'
Content type 'application/zip' length 62568 bytes (61 KB)
downloaded 61 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/munsell_0.5.1.zip'
Content type 'application/zip' length 245466 bytes (239 KB)
downloaded 239 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/RColorBrewer_1.1-3.zip'
Content type 'application/zip' length 56066 bytes (54 KB)
downloaded 54 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/viridisLite_0.4.2.zip'
Content type 'application/zip' length 1300105 bytes (1.2 MB)
downloaded 1.2 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/carData_3.0-5.zip'
Content type 'application/zip' length 1822266 bytes (1.7 MB)
downloaded 1.7 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/abind_1.4-5.zip'
Content type 'application/zip' length 63774 bytes (62 KB)
downloaded 62 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/pbkrtest_0.5.2.zip'
Content type 'application/zip' length 191208 bytes (186 KB)
downloaded 186 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/quantreg_5.97.zip'
Content type 'application/zip' length 1562933 bytes (1.5 MB)
downloaded 1.5 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/lme4_1.1-35.2.zip'
Content type 'application/zip' length 4557183 bytes (4.3 MB)
downloaded 4.3 MB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/scales_1.3.0.zip'
Content type 'application/zip' length 703730 bytes (687 KB)
downloaded 687 KB

trying URL 'https://cran.case.edu/bin/windows/contrib/4.3/car_3.1-2.zip'
Content type 'application/zip' length 1707812 bytes (1.6 MB)
downloaded 1.6 MB

package ‘fs’ successfully unpacked and MD5 sums checked
package ‘pkgbuild’ successfully unpacked and MD5 sums checked
package ‘rprojroot’ successfully unpacked and MD5 sums checked
package ‘diffobj’ successfully unpacked and MD5 sums checked
package ‘rematch2’ successfully unpacked and MD5 sums checked
package ‘stringi’ successfully unpacked and MD5 sums checked
package ‘brio’ successfully unpacked and MD5 sums checked
package ‘callr’ successfully unpacked and MD5 sums checked
package ‘desc’ successfully unpacked and MD5 sums checked
package ‘digest’ successfully unpacked and MD5 sums checked
package ‘evaluate’ successfully unpacked and MD5 sums checked
package ‘jsonlite’ successfully unpacked and MD5 sums checked
```

```
package ‘pkgload’ successfully unpacked and MD5 sums checked
package ‘praise’ successfully unpacked and MD5 sums checked
package ‘processx’ successfully unpacked and MD5 sums checked
package ‘ps’ successfully unpacked and MD5 sums checked
package ‘waldo’ successfully unpacked and MD5 sums checked
package ‘backports’ successfully unpacked and MD5 sums checked
package ‘ellipsis’ successfully unpacked and MD5 sums checked
package ‘purrr’ successfully unpacked and MD5 sums checked
package ‘stringr’ successfully unpacked and MD5 sums checked
package ‘tidyr’ successfully unpacked and MD5 sums checked
package ‘Matrix’ successfully unpacked and MD5 sums checked
package ‘testthat’ successfully unpacked and MD5 sums checked
package ‘colorspace’ successfully unpacked and MD5 sums checked
package ‘broom’ successfully unpacked and MD5 sums checked
package ‘dplyr’ successfully unpacked and MD5 sums checked
package ‘numDeriv’ successfully unpacked and MD5 sums checked
package ‘SparseM’ successfully unpacked and MD5 sums checked
package ‘MatrixModels’ successfully unpacked and MD5 sums checked
package ‘minqa’ successfully unpacked and MD5 sums checked
package ‘nloptr’ successfully unpacked and MD5 sums checked
package ‘Rcpp’ successfully unpacked and MD5 sums checked
package ‘RcppEigen’ successfully unpacked and MD5 sums checked
package ‘farver’ successfully unpacked and MD5 sums checked
package ‘labeling’ successfully unpacked and MD5 sums checked
package ‘munsell’ successfully unpacked and MD5 sums checked
package ‘RColorBrewer’ successfully unpacked and MD5 sums checked
package ‘viridisLite’ successfully unpacked and MD5 sums checked
package ‘carData’ successfully unpacked and MD5 sums checked
package ‘abind’ successfully unpacked and MD5 sums checked
package ‘pbkrtest’ successfully unpacked and MD5 sums checked
package ‘quantreg’ successfully unpacked and MD5 sums checked
package ‘lme4’ successfully unpacked and MD5 sums checked
package ‘scales’ successfully unpacked and MD5 sums checked
package ‘car’ successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\minhas01\AppData\Local\Temp\RtmpGAggMH\downloaded_packages
> library(car)
Loading required package: carData
Warning messages:
1: package ‘car’ was built under R version 4.3.3
2: package ‘carData’ was built under R version 4.3.3
> data2 <- read.csv("C:.csv")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") : cannot open file 'C:.csv': No such file or directory
> data1 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/3M TBill SA.csv")
> data2 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US CPI SA.csv")
> data3 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US IP SA.csv")
> data4 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/US Unemployment SA.csv")
> data5 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/USDebt SA.csv")
> data6 <- read.csv("C:/Users/minhas01/Desktop/Nahayan Minhas/CSV Data/USDXY SA.csv")
> data1$Date <- as.Date(data1$Date, format="%m/%d/%Y")
> data2$Date <- as.Date(data2$Date, format="%m/%d/%Y")
> data3$Date <- as.Date(data3$Date, format="%m/%d/%Y")
> data4$Date <- as.Date(data4$Date, format="%m/%d/%Y")
> data5$Date <- as.Date(data5$Date, format="%m/%d/%Y")
> data6$Date <- as.Date(data6$Date, format="%m/%d/%Y")
> ts1 <- ts(data1[,2], start=c(start_year, start_month), frequency=4)
> ts2 <- ts(data2[,2], start=c(start_year, start_month), frequency=4)
> ts3 <- ts(data3[,2], start=c(start_year, start_month), frequency=4)
> ts4 <- ts(data4[,2], start=c(start_year, start_month), frequency=4)
> ts5 <- ts(data5[,2], start=c(start_year, start_month), frequency=4)
> ts6 <- ts(data6[,2], start=c(start_year, start_month), frequency=4)
> mts_data <- cbind(ts1, ts2, ts3, ts4, ts5, ts6)
> var_model <- VAR(mts_data, p=8)
> summary(var_model)

VAR Estimation Results:
=========================
```

```
Endogenous variables: ts1, ts2, ts3, ts4, ts5, ts6
Deterministic variables: const
Sample size: 112
Log Likelihood: -1247.121
Roots of the characteristic polynomial:
0.9322 0.9322 0.9244 0.9244 0.9186 0.9186 0.9141 0.9125 0.9125 0.9087 0.9087 0.8834 0.8834 0.8809
 0.8809 0.8802 0.8802 0.8776 0.8776 0.8762 0.8762 0.871 0.871 0.8668 0.8668 0.8598 0.8598 0.8584
0.8584 0.8548 0.8548 0.8527 0.8527 0.8301 0.8301 0.8201 0.8201 0.8155 0.8155 0.7974 0.7974 0.7737
 0.7737 0.6445 0.6445 0.6214 0.6214 0.2645
Call:
VAR(y = mts_data, p = 8)


Estimation results for equation ts1:
====================================
ts1 = ts1.l1 + ts2.l1 + ts3.l1 + ts4.l1 + ts5.l1 + ts6.l1 + ts1.l2 + ts2.l2 + ts3.l2 + ts4.l2 + t
s5.l2 + ts6.l2 + ts1.l3 + ts2.l3 + ts3.l3 + ts4.l3 + ts5.l3 + ts6.l3 + ts1.l4 + ts2.l4 + ts3.l4 +
 ts4.l4 + ts5.l4 + ts6.l4 + ts1.l5 + ts2.l5 + ts3.l5 + ts4.l5 + ts5.l5 + ts6.l5 + ts1.l6 + ts2.l6
 + ts3.l6 + ts4.l6 + ts5.l6 + ts6.l6 + ts1.l7 + ts2.l7 + ts3.l7 + ts4.l7 + ts5.l7 + ts6.l7 + ts1.
l8 + ts2.l8 + ts3.l8 + ts4.l8 + ts5.l8 + ts6.l8 + const

         Estimate Std. Error t value Pr(>|t|)
ts1.l1  0.4071621  0.1451618   2.805  0.00669 **
ts2.l1  0.0160823  0.0396411   0.406  0.68634
ts3.l1  0.1195472  0.0477696   2.503  0.01494 *
ts4.l1  0.0432812  0.0983072   0.440  0.66125
ts5.l1  0.0007044  0.0006794   1.037  0.30375
ts6.l1  0.0057486  0.0118797   0.484  0.63014
ts1.l2 -0.1947620  0.1685946  -1.155  0.25237
ts2.l2  0.0161757  0.0411035   0.394  0.69525
ts3.l2 -0.0204315  0.0523692  -0.390  0.69775
ts4.l2 -0.1183711  0.1024953  -1.155  0.25250
ts5.l2  0.0006939  0.0009093   0.763  0.44826
ts6.l2  0.0073743  0.0123723   0.596  0.55329
ts1.l3  0.0849648  0.1746813   0.486  0.62837
ts2.l3 -0.0032184  0.0469967  -0.068  0.94562
ts3.l3 -0.0430236  0.0585651  -0.735  0.46529
ts4.l3 -0.1986572  0.1109458  -1.791  0.07817 .
ts5.l3  0.0010374  0.0010648   0.974  0.33365
ts6.l3 -0.0144268  0.0124745  -1.157  0.25184
ts1.l4  0.1131031  0.1790124   0.632  0.52979
ts2.l4 -0.0006448  0.0506800  -0.013  0.98989
ts3.l4 -0.0916920  0.0542368  -1.691  0.09586 .
ts4.l4 -0.2188471  0.1040333  -2.104  0.03941 *
ts5.l4  0.0014324  0.0011043   1.297  0.19930
ts6.l4  0.0011384  0.0131941   0.086  0.93152
ts1.l5 -0.1747809  0.1942699  -0.900  0.37172
ts2.l5  0.0278041  0.0442002   0.629  0.53159
ts3.l5  0.0416449  0.0549159   0.758  0.45107
ts4.l5 -0.1203155  0.1035908  -1.161  0.24984
ts5.l5  0.0017232  0.0011043   1.560  0.12367
ts6.l5 -0.0057851  0.0135024  -0.428  0.66979
ts1.l6 -0.0141550  0.1968825  -0.072  0.94291
ts2.l6 -0.0466317  0.0435009  -1.072  0.28782
ts3.l6 -0.0707582  0.0557233  -1.270  0.20882
ts4.l6 -0.1279168  0.1057858  -1.209  0.23110
ts5.l6  0.0013684  0.0010859   1.260  0.21228
ts6.l6  0.0009172  0.0132262   0.069  0.94494
ts1.l7  0.0065570  0.1919249   0.034  0.97285
ts2.l7  0.0066008  0.0417085   0.158  0.87476
ts3.l7 -0.0252425  0.0537202  -0.470  0.64006
ts4.l7 -0.1068979  0.1097950  -0.974  0.33397
ts5.l7 -0.0001113  0.0010061  -0.111  0.91225
ts6.l7 -0.0241840  0.0122268  -1.978  0.05231 .
ts1.l8 -0.1285223  0.1697864  -0.757  0.45189
ts2.l8  0.0218230  0.0409548   0.533  0.59601
ts3.l8 -0.0206138  0.0515219  -0.400  0.69044
ts4.l8 -0.0259381  0.1000662  -0.259  0.79632
ts5.l8  0.0002990  0.0008101   0.369  0.71333
ts6.l8  0.0026337  0.0116856   0.225  0.82241
```

```
const  -0.0458964  0.0860694  -0.533  0.59574
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 0.3882 on 63 degrees of freedom
Multiple R-Squared: 0.6109,     Adjusted R-squared: 0.3144
F-statistic:  2.06 on 48 and 63 DF,  p-value: 0.003652


Estimation results for equation ts2:
====================================
ts2 = ts1.l1 + ts2.l1 + ts3.l1 + ts4.l1 + ts5.l1 + ts6.l1 + ts1.l2 + ts2.l2 + ts3.l2 + ts4.l2 + t
s5.l2 + ts6.l2 + ts1.l3 + ts2.l3 + ts3.l3 + ts4.l3 + ts5.l3 + ts6.l3 + ts1.l4 + ts2.l4 + ts3.l4 +
 ts4.l4 + ts5.l4 + ts6.l4 + ts1.l5 + ts2.l5 + ts3.l5 + ts4.l5 + ts5.l5 + ts6.l5 + ts1.l6 + ts2.l6
 + ts3.l6 + ts4.l6 + ts5.l6 + ts6.l6 + ts1.l7 + ts2.l7 + ts3.l7 + ts4.l7 + ts5.l7 + ts6.l7 + ts1.
l8 + ts2.l8 + ts3.l8 + ts4.l8 + ts5.l8 + ts6.l8 + const

         Estimate Std. Error t value Pr(>|t|)
ts1.l1  0.4865300  0.4837906   1.006  0.31843
ts2.l1  0.1234462  0.1321146   0.934  0.35367
ts3.l1  0.2699293  0.1592050   1.695  0.09492 .
ts4.l1  0.0280901  0.3276353   0.086  0.93195
ts5.l1 -0.0027140  0.0022642  -1.199  0.23516
ts6.l1 -0.0787097  0.0395924  -1.988  0.05116 .
ts1.l2 -1.4108009  0.5618866  -2.511  0.01462 *
ts2.l2  0.2894691  0.1369884   2.113  0.03856 *
ts3.l2 -0.1208490  0.1745345  -0.692  0.49123
ts4.l2 -0.3626595  0.3415932  -1.062  0.29244
ts5.l2 -0.0046366  0.0030306  -1.530  0.13104
ts6.l2  0.0799286  0.0412340   1.938  0.05706 .
ts1.l3  0.3459173  0.5821722   0.594  0.55452
ts2.l3  0.2939428  0.1566291   1.877  0.06519 .
ts3.l3  0.0396321  0.1951839   0.203  0.83975
ts4.l3  0.0894819  0.3697567   0.242  0.80956
ts5.l3 -0.0002310  0.0035486  -0.065  0.94831
ts6.l3 -0.0155464  0.0415745  -0.374  0.70970
ts1.l4  1.9633173  0.5966070   3.291  0.00164 **
ts2.l4 -0.1915373  0.1689046  -1.134  0.26109
ts3.l4 -0.3217123  0.1807587  -1.780  0.07993 .
ts4.l4 -0.2089925  0.3467190  -0.603  0.54882
ts5.l4  0.0002785  0.0036803   0.076  0.93992
ts6.l4 -0.0003043  0.0439728  -0.007  0.99450
ts1.l5 -0.6630368  0.6474565  -1.024  0.30972
ts2.l5  0.0998861  0.1473090   0.678  0.50021
ts3.l5 -0.0694694  0.1830218  -0.380  0.70554
ts4.l5 -0.0101821  0.3452442  -0.029  0.97657
ts5.l5  0.0021201  0.0036805   0.576  0.56665
ts6.l5  0.0240804  0.0450003   0.535  0.59445
ts1.l6 -0.3933298  0.6561637  -0.599  0.55103
ts2.l6  0.1674896  0.1449786   1.155  0.25234
ts3.l6  0.0545068  0.1857127   0.294  0.77010
ts4.l6  0.6846945  0.3525595   1.942  0.05660 .
ts5.l6  0.0025139  0.0036191   0.695  0.48986
ts6.l6 -0.0232343  0.0440799  -0.527  0.59998
ts1.l7 -0.0266272  0.6396413  -0.042  0.96693
ts2.l7 -0.0225375  0.1390048  -0.162  0.87172
ts3.l7  0.0153348  0.1790370   0.086  0.93201
ts4.l7  0.3914556  0.3659214   1.070  0.28880
ts5.l7 -0.0007959  0.0033532  -0.237  0.81315
ts6.l7  0.0086331  0.0407490   0.212  0.83290
ts1.l8  0.6623238  0.5658587   1.170  0.24622
ts2.l8 -0.1013002  0.1364930  -0.742  0.46075
ts3.l8  0.0234016  0.1717105   0.136  0.89203
ts4.l8  0.7121714  0.3334976   2.135  0.03662 *
ts5.l8 -0.0004209  0.0027000  -0.156  0.87663
ts6.l8 -0.0005662  0.0389453  -0.015  0.98845
const   0.5705940  0.2868495   1.989  0.05103 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Residual standard error: 1.294 on 63 degrees of freedom
Multiple R-Squared: 0.6563,     Adjusted R-squared: 0.3944
F-statistic: 2.506 on 48 and 63 DF,  p-value: 0.0003387


Estimation results for equation ts3:
====================================
ts3 = ts1.l1 + ts2.l1 + ts3.l1 + ts4.l1 + ts5.l1 + ts6.l1 + ts1.l2 + ts2.l2 + ts3.l2 + ts4.l2 + t
s5.l2 + ts6.l2 + ts1.l3 + ts2.l3 + ts3.l3 + ts4.l3 + ts5.l3 + ts6.l3 + ts1.l4 + ts2.l4 + ts3.l4 +
 ts4.l4 + ts5.l4 + ts6.l4 + ts1.l5 + ts2.l5 + ts3.l5 + ts4.l5 + ts5.l5 + ts6.l5 + ts1.l6 + ts2.l6
 + ts3.l6 + ts4.l6 + ts5.l6 + ts6.l6 + ts1.l7 + ts2.l7 + ts3.l7 + ts4.l7 + ts5.l7 + ts6.l7 + ts1.
l8 + ts2.l8 + ts3.l8 + ts4.l8 + ts5.l8 + ts6.l8 + const

         Estimate Std. Error t value Pr(>|t|)
ts1.l1  0.7472428  0.4412190   1.694  0.09528 .
ts2.l1  0.2792941  0.1204890   2.318  0.02371 *
ts3.l1  0.4702884  0.1451956   3.239  0.00192 **
ts4.l1  0.8176421  0.2988047   2.736  0.00806 **
ts5.l1 -0.0057669  0.0020650  -2.793  0.00691 **
ts6.l1 -0.0126742  0.0361084  -0.351  0.72676
ts1.l2 -0.0164987  0.5124428  -0.032  0.97442
ts2.l2 -0.2214761  0.1249340  -1.773  0.08111 .
ts3.l2  0.2572225  0.1591762   1.616  0.11110
ts4.l2  0.5165079  0.3115343   1.658  0.10230
ts5.l2 -0.0041990  0.0027639  -1.519  0.13371
ts6.l2  0.0697133  0.0376056   1.854  0.06845 .
ts1.l3  1.5272667  0.5309434   2.877  0.00548 **
ts2.l3 -0.4227306  0.1428464  -2.959  0.00434 **
ts3.l3 -0.0860550  0.1780085  -0.483  0.63047
ts4.l3 -0.2863717  0.3372196  -0.849  0.39898
ts5.l3 -0.0024300  0.0032364  -0.751  0.45554
ts6.l3 -0.0951239  0.0379162  -2.509  0.01470 *
ts1.l4 -0.9112222  0.5441080  -1.675  0.09895 .
ts2.l4  0.1171806  0.1540417   0.761  0.44967
ts3.l4 -0.0290964  0.1648527  -0.176  0.86047
ts4.l4 -0.0106475  0.3162091  -0.034  0.97324
ts5.l4 -0.0024404  0.0033564  -0.727  0.46986
ts6.l4  0.0662106  0.0401034   1.651  0.10372
ts1.l5 -1.1586452  0.5904829  -1.962  0.05416 .
ts2.l5  0.1581621  0.1343464   1.177  0.24352
ts3.l5  0.1179862  0.1669167   0.707  0.48226
ts4.l5 -0.1008534  0.3148641  -0.320  0.74980
ts5.l5  0.0015400  0.0033567   0.459  0.64796
ts6.l5 -0.0192163  0.0410405  -0.468  0.64124
ts1.l6  1.1171412  0.5984239   1.867  0.06658 .
ts2.l6 -0.1439382  0.1322210  -1.089  0.28047
ts3.l6 -0.1336546  0.1693707  -0.789  0.43300
ts4.l6  0.3625947  0.3215357   1.128  0.26372
ts5.l6  0.0046882  0.0033007   1.420  0.16043
ts6.l6  0.0289977  0.0402011   0.721  0.47338
ts1.l7 -0.2820099  0.5833555  -0.483  0.63047
ts2.l7  0.2033183  0.1267729   1.604  0.11376
ts3.l7  0.0533235  0.1632825   0.327  0.74507
ts4.l7  0.6368697  0.3337218   1.908  0.06090 .
ts5.l7 -0.0007831  0.0030581  -0.256  0.79874
ts6.l7  0.0682590  0.0371632   1.837  0.07097 .
ts1.l8  0.4824547  0.5160654   0.935  0.35342
ts2.l8 -0.1014239  0.1244822  -0.815  0.41828
ts3.l8 -0.0111756  0.1566007  -0.071  0.94333
ts4.l8  0.0666626  0.3041511   0.219  0.82722
ts5.l8  0.0005343  0.0024624   0.217  0.82892
ts6.l8 -0.0622793  0.0355182  -1.753  0.08439 .
const   0.3379266  0.2616079   1.292  0.20117
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 1.18 on 63 degrees of freedom
```

```
Multiple R-Squared: 0.6628,     Adjusted R-squared: 0.406
F-statistic:  2.58 on 48 and 63 DF,  p-value: 0.0002283


Estimation results for equation ts4:
====================================
ts4 = ts1.l1 + ts2.l1 + ts3.l1 + ts4.l1 + ts5.l1 + ts6.l1 + ts1.l2 + ts2.l2 + ts3.l2 + ts4.l2 + t
s5.l2 + ts6.l2 + ts1.l3 + ts2.l3 + ts3.l3 + ts4.l3 + ts5.l3 + ts6.l3 + ts1.l4 + ts2.l4 + ts3.l4 +
 ts4.l4 + ts5.l4 + ts6.l4 + ts1.l5 + ts2.l5 + ts3.l5 + ts4.l5 + ts5.l5 + ts6.l5 + ts1.l6 + ts2.l6
 + ts3.l6 + ts4.l6 + ts5.l6 + ts6.l6 + ts1.l7 + ts2.l7 + ts3.l7 + ts4.l7 + ts5.l7 + ts6.l7 + ts1.
l8 + ts2.l8 + ts3.l8 + ts4.l8 + ts5.l8 + ts6.l8 + const

         Estimate Std. Error t value Pr(>|t|)
ts1.l1 -6.604e-01  2.161e-01  -3.057 0.003280 **
ts2.l1 -7.504e-02  5.900e-02  -1.272 0.208077
ts3.l1 -2.625e-01  7.110e-02  -3.692 0.000467 ***
ts4.l1 -3.571e-01  1.463e-01  -2.440 0.017497 *
ts5.l1  4.593e-03  1.011e-03   4.542 2.58e-05 ***
ts6.l1  1.378e-02  1.768e-02   0.780 0.438570
ts1.l2  1.900e-01  2.509e-01   0.757 0.451838
ts2.l2  1.358e-01  6.118e-02   2.220 0.030052 *
ts3.l2  1.740e-01  7.794e-02   2.233 0.029131 *
ts4.l2  2.349e-01  1.526e-01   1.539 0.128691
ts5.l2  5.182e-03  1.353e-03   3.829 0.000299 ***
ts6.l2 -1.219e-02  1.841e-02  -0.662 0.510561
ts1.l3 -4.195e-01  2.600e-01  -1.614 0.111599
ts2.l3 -2.317e-02  6.995e-02  -0.331 0.741600
ts3.l3  1.949e-02  8.717e-02   0.224 0.823757
ts4.l3 -4.530e-02  1.651e-01  -0.274 0.784747
ts5.l3  2.854e-03  1.585e-03   1.801 0.076514 .
ts6.l3  3.606e-02  1.857e-02   1.942 0.056619 .
ts1.l4  5.691e-01  2.664e-01   2.136 0.036563 *
ts2.l4 -1.151e-01  7.543e-02  -1.526 0.131948
ts3.l4 -1.009e-01  8.072e-02  -1.250 0.215845
ts4.l4 -2.302e-01  1.548e-01  -1.486 0.142156
ts5.l4  3.183e-03  1.644e-03   1.937 0.057258 .
ts6.l4 -4.774e-02  1.964e-02  -2.431 0.017909 *
ts1.l5  8.159e-02  2.891e-01   0.282 0.778739
ts2.l5  3.875e-02  6.579e-02   0.589 0.557979
ts3.l5 -1.158e-01  8.174e-02  -1.417 0.161493
ts4.l5 -1.606e-01  1.542e-01  -1.041 0.301674
ts5.l5  1.890e-03  1.644e-03   1.150 0.254530
ts6.l5  8.140e-04  2.010e-02   0.041 0.967818
ts1.l6 -6.167e-01  2.930e-01  -2.105 0.039315 *
ts2.l6  9.863e-02  6.475e-02   1.523 0.132672
ts3.l6  3.402e-02  8.294e-02   0.410 0.683094
ts4.l6 -1.319e-01  1.574e-01  -0.838 0.405402
ts5.l6 -8.530e-04  1.616e-03  -0.528 0.599514
ts6.l6  5.265e-03  1.969e-02   0.267 0.790008
ts1.l7  4.386e-01  2.857e-01   1.535 0.129710
ts2.l7 -7.969e-02  6.208e-02  -1.284 0.203921
ts3.l7  4.159e-02  7.996e-02   0.520 0.604771
ts4.l7 -1.462e-02  1.634e-01  -0.089 0.928981
ts5.l7 -2.419e-06  1.497e-03  -0.002 0.998716
ts6.l7 -1.855e-02  1.820e-02  -1.019 0.311904
ts1.l8 -2.756e-01  2.527e-01  -1.090 0.279669
ts2.l8  8.396e-02  6.096e-02   1.377 0.173268
ts3.l8  5.434e-02  7.668e-02   0.709 0.481183
ts4.l8  1.344e-01  1.489e-01   0.903 0.370123
ts5.l8  9.899e-04  1.206e-03   0.821 0.414780
ts6.l8  2.300e-02  1.739e-02   1.323 0.190740
const  -7.036e-02  1.281e-01  -0.549 0.584778
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 0.5778 on 63 degrees of freedom
Multiple R-Squared: 0.6891,     Adjusted R-squared: 0.4522
F-statistic: 2.909 on 48 and 63 DF,  p-value: 4.108e-05
```

```
Estimation results for equation ts5:
====================================
ts5 = ts1.l1 + ts2.l1 + ts3.l1 + ts4.l1 + ts5.l1 + ts6.l1 + ts1.l2 + ts2.l2 + ts3.l2 + ts4.l2 + t
s5.l2 + ts6.l2 + ts1.l3 + ts2.l3 + ts3.l3 + ts4.l3 + ts5.l3 + ts6.l3 + ts1.l4 + ts2.l4 + ts3.l4 +
 ts4.l4 + ts5.l4 + ts6.l4 + ts1.l5 + ts2.l5 + ts3.l5 + ts4.l5 + ts5.l5 + ts6.l5 + ts1.l6 + ts2.l6
 + ts3.l6 + ts4.l6 + ts5.l6 + ts6.l6 + ts1.l7 + ts2.l7 + ts3.l7 + ts4.l7 + ts5.l7 + ts6.l7 + ts1.
l8 + ts2.l8 + ts3.l8 + ts4.l8 + ts5.l8 + ts6.l8 + const

         Estimate Std. Error t value Pr(>|t|)
ts1.l1  32.821601  27.033668   1.214  0.22924
ts2.l1  -7.535064   7.382412  -1.021  0.31131
ts3.l1  -4.901373   8.896192  -0.551  0.58362
ts4.l1 -28.279361  18.307885  -1.545  0.12744
ts5.l1  -0.715936   0.126522  -5.659    4e-07 ***
ts6.l1  -1.911617   2.212377  -0.864  0.39084
ts1.l2 -10.316124  31.397584  -0.329  0.74357
ts2.l2  -0.744272   7.654756  -0.097  0.92285
ts3.l2  -9.517544   9.752789  -0.976  0.33286
ts4.l2 -26.782217  19.087838  -1.403  0.16550
ts5.l2  -0.518616   0.169346  -3.062  0.00323 **
ts6.l2  -1.342462   2.304108  -0.583  0.56222
ts1.l3 -39.274415  32.531121  -1.207  0.23183
ts2.l3  16.461617   8.752257   1.881  0.06462 .
ts3.l3  10.636012  10.906657   0.975  0.33320
ts4.l3   9.670365  20.661584   0.468  0.64137
ts5.l3  -0.315262   0.198294  -1.590  0.11687
ts6.l3   3.705391   2.323138   1.595  0.11572
ts1.l4 -16.773062  33.337720  -0.503  0.61663
ts2.l4 -11.905202   9.438200  -1.261  0.21182
ts3.l4  -7.586657  10.100592  -0.751  0.45538
ts4.l4  -4.201211  19.374262  -0.217  0.82903
ts5.l4  -0.035127   0.205649  -0.171  0.86492
ts6.l4  -0.898736   2.457151  -0.366  0.71577
ts1.l5  24.980211  36.179131   0.690  0.49244
ts2.l5   0.268073   8.231459   0.033  0.97412
ts3.l5   7.462809  10.227052   0.730  0.46827
ts4.l5  18.674524  19.291855   0.968  0.33675
ts5.l5   0.062026   0.205664   0.302  0.76396
ts6.l5  -0.947200   2.514567  -0.377  0.70767
ts1.l6   1.468969  36.665682   0.040  0.96817
ts2.l6   8.156117   8.101237   1.007  0.31789
ts3.l6  -2.270087  10.377414  -0.219  0.82755
ts4.l6 -32.350416  19.700624  -1.642  0.10555
ts5.l6  -0.001018   0.202233  -0.005  0.99600
ts6.l6   3.019005   2.463135   1.226  0.22488
ts1.l7 -35.046546  35.742430  -0.981  0.33057
ts2.l7   0.113709   7.767430   0.015  0.98837
ts3.l7 -10.646313  10.004385  -1.064  0.29132
ts4.l7   4.647118  20.447272   0.227  0.82095
ts5.l7   0.291681   0.187372   1.557  0.12455
ts6.l7  -1.695982   2.277006  -0.745  0.45914
ts1.l8  56.023073  31.619541   1.772  0.08127 .
ts2.l8  -0.099078   7.627075  -0.013  0.98968
ts3.l8  -5.057765   9.594990  -0.527  0.59996
ts4.l8   3.962720  18.635465   0.213  0.83229
ts5.l8   0.035074   0.150872   0.232  0.81692
ts6.l8  -0.494233   2.176216  -0.227  0.82108
const    1.440807  16.028825   0.090  0.92866
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 72.3 on 63 degrees of freedom
Multiple R-Squared: 0.6379,     Adjusted R-squared: 0.3621
F-statistic: 2.313 on 48 and 63 DF,  p-value: 0.0009478


Estimation results for equation ts6:
====================================
```

```
ts6 = ts1.l1 + ts2.l1 + ts3.l1 + ts4.l1 + ts5.l1 + ts6.l1 + ts1.l2 + ts2.l2 + ts3.l2 + ts4.l2 + t
s5.l2 + ts6.l2 + ts1.l3 + ts2.l3 + ts3.l3 + ts4.l3 + ts5.l3 + ts6.l3 + ts1.l4 + ts2.l4 + ts3.l4 +
 ts4.l4 + ts5.l4 + ts6.l4 + ts1.l5 + ts2.l5 + ts3.l5 + ts4.l5 + ts5.l5 + ts6.l5 + ts1.l6 + ts2.l6
 + ts3.l6 + ts4.l6 + ts5.l6 + ts6.l6 + ts1.l7 + ts2.l7 + ts3.l7 + ts4.l7 + ts5.l7 + ts6.l7 + ts1.
l8 + ts2.l8 + ts3.l8 + ts4.l8 + ts5.l8 + ts6.l8 + const

         Estimate Std. Error t value Pr(>|t|)
ts1.l1 -1.2293446  1.6530222  -0.744   0.4598
ts2.l1  0.0007628  0.4514108   0.002   0.9987
ts3.l1 -0.2504653  0.5439737  -0.460   0.6468
ts4.l1 -0.1770179  1.1194686  -0.158   0.8749
ts5.l1 -0.0079054  0.0077364  -1.022   0.3108
ts6.l1  0.3103586  0.1352797   2.294   0.0251 *
ts1.l2  0.6311613  1.9198617   0.329   0.7434
ts2.l2  1.1230868  0.4680638   2.399   0.0194 *
ts3.l2  1.2723178  0.5963518   2.134   0.0368 *
ts4.l2  0.3478962  1.1671602   0.298   0.7666
ts5.l2 -0.0067309  0.0103549  -0.650   0.5180
ts6.l2 -0.0605006  0.1408888  -0.429   0.6691
ts1.l3 -1.0904248  1.9891739  -0.548   0.5855
ts2.l3 -0.0556761  0.5351725  -0.104   0.9175
ts3.l3 -0.8555631  0.6669071  -1.283   0.2042
ts4.l3 -1.3537068  1.2633897  -1.071   0.2880
ts5.l3 -0.0061007  0.0121251  -0.503   0.6166
ts6.l3  0.1425150  0.1420525   1.003   0.3196
ts1.l4  1.4591287  2.0384948   0.716   0.4768
ts2.l4 -0.0770539  0.5771157  -0.134   0.8942
ts3.l4 -0.7536060  0.6176189  -1.220   0.2269
ts4.l4 -0.6162567  1.1846741  -0.520   0.6048
ts5.l4 -0.0019804  0.0125748  -0.157   0.8754
ts6.l4 -0.1046583  0.1502469  -0.697   0.4886
ts1.l5 -0.6576626  2.2122380  -0.297   0.7672
ts2.l5  0.0877852  0.5033273   0.174   0.8621
ts3.l5  0.3905925  0.6253515   0.625   0.5345
ts4.l5  1.1187548  1.1796351   0.948   0.3466
ts5.l5  0.0001960  0.0125757   0.016   0.9876
ts6.l5  0.0291660  0.1537577   0.190   0.8502
ts1.l6  0.3196639  2.2419890   0.143   0.8871
ts2.l6 -0.5319242  0.4953647  -1.074   0.2870
ts3.l6  0.3735680  0.6345456   0.589   0.5582
ts4.l6 -0.0524203  1.2046301  -0.044   0.9654
ts5.l6  0.0004142  0.0123659   0.033   0.9734
ts6.l6  0.0842294  0.1506128   0.559   0.5780
ts1.l7  2.4135478  2.1855351   1.104   0.2737
ts2.l7 -0.4375741  0.4749535  -0.921   0.3604
ts3.l7 -0.5854969  0.6117361  -0.957   0.3422
ts4.l7 -0.5107655  1.2502852  -0.409   0.6843
ts5.l7 -0.0089175  0.0114572  -0.778   0.4393
ts6.l7 -0.1444436  0.1392316  -1.037   0.3035
ts1.l8 -1.8050282  1.9334337  -0.934   0.3541
ts2.l8  0.0699947  0.4663712   0.150   0.8812
ts3.l8  0.6028339  0.5867029   1.027   0.3081
ts4.l8 -0.2138626  1.1394990  -0.188   0.8517
ts5.l8 -0.0151946  0.0092253  -1.647   0.1045
ts6.l8 -0.0334160  0.1330687  -0.251   0.8025
const  -0.5054263  0.9801113  -0.516   0.6079
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 4.421 on 63 degrees of freedom
Multiple R-Squared: 0.431,      Adjusted R-squared: -0.002592
F-statistic: 0.994 on 48 and 63 DF,  p-value: 0.5039



Covariance matrix of residuals:
        ts1     ts2      ts3      ts4       ts5      ts6
ts1  0.15073  0.1485   0.1092  0.01212   -6.5221   0.2990
ts2  0.14846  1.6742   0.1149 -0.17243   -9.8369  -1.0350
```

```
ts3  0.10916  0.1149   1.3925 -0.26579  -10.1710  -0.5622
ts4  0.01212 -0.1724  -0.2658  0.33391   -0.2102  -0.2496
ts5 -6.52208 -9.8369 -10.1710 -0.21022 5227.6613 -25.0753
ts6  0.29901 -1.0350  -0.5622 -0.24961  -25.0753  19.5459

Correlation matrix of residuals:
         ts1      ts2      ts3       ts4       ts5      ts6
ts1  1.00000  0.29554  0.23827  0.054045 -0.232344  0.17420
ts2  0.29554  1.00000  0.07523 -0.230618 -0.105148 -0.18093
ts3  0.23827  0.07523  1.00000 -0.389787 -0.119208 -0.10775
ts4  0.05404 -0.23062 -0.38979  1.000000 -0.005032 -0.09770
ts5 -0.23234 -0.10515 -0.11921 -0.005032  1.000000 -0.07844
ts6  0.17420 -0.18093 -0.10775 -0.097704 -0.078445  1.00000


> save.image("C:\\Users\\minhas01\\Desktop\\Nahayan Minhas\\Workspace main")
> AIC <- AIC(var_model)
> BIC <- BIC(var_model)
> HQC <- summary(var_model)$criteria['HQ']
> cat("AIC:", AIC, "\n")
AIC: 3082.242
> cat("BIC:", BIC, "\n")
BIC: 3881.481
> cat("HQC:", HQC, "\n")
HQC:
> log_likelihood <- logLik(var_model)
> num_parameters <- length(coef(var_model))num_parameters <- length(coef(var_model))
Error: unexpected symbol in "num_parameters <- length(coef(var_model))num_parameters"
> num_parameters <- length(coef(var_model))
> num_observations <- length(var_model$y)/ncol(var_model$y)
> residual_variance <- as.numeric(-2 * log_likelihood / num_observations)
> HQC <- log(residual_variance) + (2 * log(log(num_observations)) * num_parameters) / num_observa
tions
> cat("HQC:", HQC, "\n")
HQC: 3.190849
> num_observations <- nobs(var_model)
Error in nobs.default(var_model) : no 'nobs' method is available
> num_observations <- length(residuals(var_model))
> HQC <- -2 * as.numeric(log_likelihood) + 2 * num_parameters * log(log(num_observations))
> cat("HQC:", HQC, "\n")
HQC: 2516.723
> HQC <- -2 * as.numeric(log_likelihood) + 2 * num_parameters * log(log(num_observations))
> cat("HQC:", HQC, "\n")
HQC: 2516.723
>
```