Untitled

2025-04-13

## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

library(foreign)  
library(car)

## Loading required package: carData

library(carData)  
library(zoo)

##   
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':  
##   
## as.Date, as.Date.numeric

library(lmtest)  
library(dynlm)  
library(sandwich)  
library(stargazer)

##   
## Please cite as:

## Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables.

## R package version 5.2.3. https://CRAN.R-project.org/package=stargazer

library(dplyr)

##   
## Attaching package: 'dplyr'

## The following object is masked from 'package:car':  
##   
## recode

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

library(systemfit)

## Loading required package: Matrix

##   
## Please cite the 'systemfit' package as:  
## Arne Henningsen and Jeff D. Hamann (2007). systemfit: A Package for Estimating Systems of Simultaneous Equations in R. Journal of Statistical Software 23(4), 1-40. http://www.jstatsoft.org/v23/i04/.  
##   
## If you have questions, suggestions, or comments regarding the 'systemfit' package, please use a forum or 'tracker' at systemfit's R-Forge site:  
## https://r-forge.r-project.org/projects/systemfit/

library(caTools)  
library(readxl)  
library(stats)  
library(AER)

## Loading required package: survival

library(stringr)  
library(mlogit)

## Loading required package: dfidx

##   
## Attaching package: 'dfidx'

## The following object is masked from 'package:stats':  
##   
## filter

library(nnet)  
library(caret)

## Loading required package: ggplot2

## Loading required package: lattice

##   
## Attaching package: 'caret'

## The following object is masked from 'package:survival':  
##   
## cluster

library(reshape2)  
library(survival)  
library(xts)

## Warning: package 'xts' was built under R version 4.4.2

##   
## ######################### Warning from 'xts' package ##########################  
## # #  
## # The dplyr lag() function breaks how base R's lag() function is supposed to #  
## # work, which breaks lag(my\_xts). Calls to lag(my\_xts) that you type or #  
## # source() into this session won't work correctly. #  
## # #  
## # Use stats::lag() to make sure you're not using dplyr::lag(), or you can add #  
## # conflictRules('dplyr', exclude = 'lag') to your .Rprofile to stop #  
## # dplyr from breaking base R's lag() function. #  
## # #  
## # Code in packages is not affected. It's protected by R's namespace mechanism #  
## # Set `options(xts.warn\_dplyr\_breaks\_lag = FALSE)` to suppress this warning. #  
## # #  
## ###############################################################################

##   
## Attaching package: 'xts'

## The following objects are masked from 'package:dplyr':  
##   
## first, last

library(forecast)

## Registered S3 method overwritten by 'quantmod':  
## method from  
## as.zoo.data.frame zoo

library(Metrics)

## Warning: package 'Metrics' was built under R version 4.4.2

##   
## Attaching package: 'Metrics'

## The following object is masked from 'package:forecast':  
##   
## accuracy

## The following objects are masked from 'package:caret':  
##   
## precision, recall

library(tseries)  
library(tsutils)

## Warning: package 'tsutils' was built under R version 4.4.2

## Registered S3 method overwritten by 'greybox':  
## method from  
## print.pcor lava

library(ggplot2)  
library(urca)

## Warning: package 'urca' was built under R version 4.4.3

library(rugarch)

## Warning: package 'rugarch' was built under R version 4.4.3

## Loading required package: parallel

##   
## Attaching package: 'rugarch'

## The following object is masked from 'package:stats':  
##   
## sigma

library(vars)

## Warning: package 'vars' was built under R version 4.4.3

## Loading required package: MASS

##   
## Attaching package: 'MASS'

## The following object is masked from 'package:dfidx':  
##   
## select

## The following object is masked from 'package:dplyr':  
##   
## select

## Loading required package: strucchange

## Warning: package 'strucchange' was built under R version 4.4.3

##   
## Attaching package: 'strucchange'

## The following object is masked from 'package:stringr':  
##   
## boundary

price=read\_excel("E:/NEU SLIDE/TIMES SERIES/General2.xlsx")

## New names:  
## • `` -> `...5`  
## • `` -> `...6`

price=ts(price, start=1)  
price=data.frame(price)  
  
AGR=price$pAGR  
SHS=price$pSHS  
VOS=price$pVOS  
VSC=price$pVSC  
  
diffAGR=diff(AGR)  
diffSHS=diff(SHS)  
diffVOS=diff(VOS)  
diffVSC=diff(VSC)  
  
#ADF chuỗi giá  
#Kiểm định none  
summary(ur.df(AGR,type = "none",lag = 0)) #Chuỗi ko dừng

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2257.24 -207.32 -5.47 242.93 1691.55   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## z.lag.1 0.000416 0.001324 0.314 0.753  
##   
## Residual standard error: 481.5 on 496 degrees of freedom  
## Multiple R-squared: 0.000199, Adjusted R-squared: -0.001817   
## F-statistic: 0.09873 on 1 and 496 DF, p-value: 0.7535  
##   
##   
## Value of test-statistic is: 0.3142   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

summary(ur.df(SHS,type = "none",lag = 0)) #Chuỗi ko dừng

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1799.43 -199.51 0.44 200.35 1700.51   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## z.lag.1 -2.738e-05 1.196e-03 -0.023 0.982  
##   
## Residual standard error: 416 on 496 degrees of freedom  
## Multiple R-squared: 1.056e-06, Adjusted R-squared: -0.002015   
## F-statistic: 0.0005238 on 1 and 496 DF, p-value: 0.9817  
##   
##   
## Value of test-statistic is: -0.0229   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

summary(ur.df(VOS,type = "none",lag = 0)) #Chuỗi ko dừng

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1409.19 -205.12 -5.33 194.53 1390.59   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## z.lag.1 0.0004593 0.0013213 0.348 0.728  
##   
## Residual standard error: 393.5 on 496 degrees of freedom  
## Multiple R-squared: 0.0002435, Adjusted R-squared: -0.001772   
## F-statistic: 0.1208 on 1 and 496 DF, p-value: 0.7283  
##   
##   
## Value of test-statistic is: 0.3476   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

summary(ur.df(VSC,type = "none",lag = 0)) #Chuỗi ko dừng

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1388.14 -179.84 5.59 194.43 1402.55   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## z.lag.1 -0.0003484 0.0009342 -0.373 0.709  
##   
## Residual standard error: 381.5 on 496 degrees of freedom  
## Multiple R-squared: 0.0002803, Adjusted R-squared: -0.001735   
## F-statistic: 0.1391 on 1 and 496 DF, p-value: 0.7094  
##   
##   
## Value of test-statistic is: -0.3729   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

#Kiểm định drift  
summary(ur.df(AGR,type = "drift",lag = 0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2249.62 -224.65 -4.39 221.18 1734.93   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 206.954344 91.611875 2.259 0.0243 \*  
## z.lag.1 -0.011916 0.005616 -2.122 0.0344 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 479.6 on 495 degrees of freedom  
## Multiple R-squared: 0.009013, Adjusted R-squared: 0.007011   
## F-statistic: 4.502 on 1 and 495 DF, p-value: 0.03435  
##   
##   
## Value of test-statistic is: -2.1218 2.6014   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

summary(ur.df(SHS,type = "drift",lag = 0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1753.15 -181.18 0.46 170.50 1727.52   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 154.171392 83.505952 1.846 0.0655 .  
## z.lag.1 -0.009664 0.005354 -1.805 0.0717 .  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 415 on 495 degrees of freedom  
## Multiple R-squared: 0.006538, Adjusted R-squared: 0.004531   
## F-statistic: 3.258 on 1 and 495 DF, p-value: 0.0717  
##   
##   
## Value of test-statistic is: -1.8049 1.7046   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

summary(ur.df(VOS,type = "drift",lag = 0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1357.19 -192.84 -18.41 180.04 1446.68   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 112.180955 83.824181 1.338 0.181  
## z.lag.1 -0.007749 0.006274 -1.235 0.217  
##   
## Residual standard error: 393.2 on 495 degrees of freedom  
## Multiple R-squared: 0.003072, Adjusted R-squared: 0.001058   
## F-statistic: 1.526 on 1 and 495 DF, p-value: 0.2174  
##   
##   
## Value of test-statistic is: -1.2351 0.956   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

summary(ur.df(VSC,type = "drift",lag = 0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1339.76 -178.73 -26.97 175.11 1449.88   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 412.511295 180.184813 2.289 0.0225 \*  
## z.lag.1 -0.022767 0.009837 -2.315 0.0210 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 379.9 on 495 degrees of freedom  
## Multiple R-squared: 0.01071, Adjusted R-squared: 0.008708   
## F-statistic: 5.357 on 1 and 495 DF, p-value: 0.02105  
##   
##   
## Value of test-statistic is: -2.3145 2.6908   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

#Kiểm định trend:  
summary(ur.df(AGR, type="trend", lag=0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2224.42 -220.78 -18.31 217.66 1742.39   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 256.80784 105.39634 2.437 0.0152 \*  
## z.lag.1 -0.01868 0.00903 -2.069 0.0391 \*  
## tt 0.23072 0.24110 0.957 0.3391   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 479.6 on 494 degrees of freedom  
## Multiple R-squared: 0.01085, Adjusted R-squared: 0.006842   
## F-statistic: 2.708 on 2 and 494 DF, p-value: 0.06763  
##   
##   
## Value of test-statistic is: -2.0688 2.0392 2.7085   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

summary(ur.df(SHS, type="trend", lag=0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1759.10 -182.53 9.59 178.45 1709.27   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 147.174734 84.006025 1.752 0.0804 .  
## z.lag.1 -0.007276 0.006151 -1.183 0.2374   
## tt -0.117715 0.149033 -0.790 0.4300   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 415.1 on 494 degrees of freedom  
## Multiple R-squared: 0.007791, Adjusted R-squared: 0.003774   
## F-statistic: 1.94 on 2 and 494 DF, p-value: 0.1449  
##   
##   
## Value of test-statistic is: -1.1829 1.3435 1.9395   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

summary(ur.df(VOS, type="trend", lag=0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1308.26 -198.80 -12.57 180.76 1505.55   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 204.082328 93.671205 2.179 0.0298 \*  
## z.lag.1 -0.022177 0.009134 -2.428 0.0155 \*  
## tt 0.387728 0.178987 2.166 0.0308 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 391.8 on 494 degrees of freedom  
## Multiple R-squared: 0.01245, Adjusted R-squared: 0.008455   
## F-statistic: 3.115 on 2 and 494 DF, p-value: 0.04526  
##   
##   
## Value of test-statistic is: -2.4279 2.2063 3.1148   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

summary(ur.df(VSC, type="trend", lag=0)) #Ko

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1336.38 -181.47 -27.85 162.99 1452.49   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 421.330751 181.158291 2.326 0.0204 \*  
## z.lag.1 -0.022427 0.009867 -2.273 0.0235 \*  
## tt -0.060365 0.119130 -0.507 0.6126   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 380.2 on 494 degrees of freedom  
## Multiple R-squared: 0.01122, Adjusted R-squared: 0.007217   
## F-statistic: 2.803 on 2 and 494 DF, p-value: 0.0616  
##   
##   
## Value of test-statistic is: -2.2729 1.8767 2.8029   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

#ADF chuỗi sai phân bậc 1  
#Kiểm định none  
summary(ur.df(diffAGR,type = "none",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2233.90 -180.97 22.33 234.32 1700.00   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## z.lag.1 -1.16103 0.04436 -26.17 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 475.8 on 495 degrees of freedom  
## Multiple R-squared: 0.5805, Adjusted R-squared: 0.5797   
## F-statistic: 685.1 on 1 and 495 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -26.1736   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

summary(ur.df(diffSHS,type = "none",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1818.16 -183.12 8.44 183.12 1700.00   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## z.lag.1 -1.08440 0.04479 -24.21 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 414.8 on 495 degrees of freedom  
## Multiple R-squared: 0.5422, Adjusted R-squared: 0.5413   
## F-statistic: 586.3 on 1 and 495 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -24.2128   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

summary(ur.df(diffVOS,type = "none",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1311.6 -200.7 0.0 200.0 1329.6   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## z.lag.1 -0.90399 0.04474 -20.21 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 392.1 on 495 degrees of freedom  
## Multiple R-squared: 0.452, Adjusted R-squared: 0.4509   
## F-statistic: 408.3 on 1 and 495 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -20.2058   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

summary(ur.df(diffVSC,type = "none",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression none   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 - 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1398.77 -188.28 -1.94 194.08 1394.14   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## z.lag.1 -0.99321 0.04496 -22.09 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 381.9 on 495 degrees of freedom  
## Multiple R-squared: 0.4964, Adjusted R-squared: 0.4954   
## F-statistic: 487.9 on 1 and 495 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -22.089   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau1 -2.58 -1.95 -1.62

#Kiểm định drift  
summary(ur.df(diffAGR,type = "drift",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2254.93 -204.69 1.67 213.97 1678.80   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 21.19789 21.37826 0.992 0.322   
## z.lag.1 -1.16268 0.04439 -26.192 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 475.8 on 494 degrees of freedom  
## Multiple R-squared: 0.5814, Adjusted R-squared: 0.5805   
## F-statistic: 686 on 1 and 494 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -26.1919 343.0088   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

summary(ur.df(diffSHS,type = "drift",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1826.99 -191.36 0.17 174.74 1691.69   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 8.31074 18.64329 0.446 0.656   
## z.lag.1 -1.08477 0.04483 -24.197 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 415.1 on 494 degrees of freedom  
## Multiple R-squared: 0.5424, Adjusted R-squared: 0.5415   
## F-statistic: 585.5 on 1 and 494 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -24.1973 292.7551   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

summary(ur.df(diffVOS,type = "drift",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1321.48 -210.21 -9.61 190.39 1319.06   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 9.60937 17.62608 0.545 0.586   
## z.lag.1 -0.90469 0.04479 -20.199 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 392.4 on 494 degrees of freedom  
## Multiple R-squared: 0.4523, Adjusted R-squared: 0.4512   
## F-statistic: 408 on 1 and 494 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -20.1988 203.9954   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

summary(ur.df(diffVSC,type = "drift",lag = 0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression drift   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1396.21 -185.73 0.61 196.58 1396.68   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.53901 17.16536 -0.148 0.882   
## z.lag.1 -0.99325 0.04501 -22.068 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 382.3 on 494 degrees of freedom  
## Multiple R-squared: 0.4964, Adjusted R-squared: 0.4954   
## F-statistic: 487 on 1 and 494 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -22.0677 243.4909   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau2 -3.44 -2.87 -2.57  
## phi1 6.47 4.61 3.79

#Kiểm định trend:  
summary(ur.df(diffAGR, type="trend", lag=0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -2266.97 -201.90 -0.09 218.47 1697.28   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 68.47599 42.84069 1.598 0.111   
## z.lag.1 -1.16536 0.04441 -26.239 <2e-16 \*\*\*  
## tt -0.19006 0.14928 -1.273 0.204   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 475.5 on 493 degrees of freedom  
## Multiple R-squared: 0.5827, Adjusted R-squared: 0.581   
## F-statistic: 344.3 on 2 and 493 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -26.2393 229.5004 344.2505   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

summary(ur.df(diffSHS, type="trend", lag=0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1851.9 -173.1 10.4 159.5 1672.8   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 65.20155 37.34722 1.746 0.0815 .   
## z.lag.1 -1.09021 0.04484 -24.312 <2e-16 \*\*\*  
## tt -0.22877 0.13022 -1.757 0.0796 .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 414.3 on 493 degrees of freedom  
## Multiple R-squared: 0.5452, Adjusted R-squared: 0.5434   
## F-statistic: 295.5 on 2 and 493 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -24.3118 197.0231 295.5346   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

summary(ur.df(diffVOS, type="trend", lag=0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1329.09 -212.01 -6.92 193.75 1310.75   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -7.17247 35.31757 -0.203 0.839   
## z.lag.1 -0.90536 0.04484 -20.192 <2e-16 \*\*\*  
## tt 0.06756 0.12318 0.548 0.584   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 392.7 on 493 degrees of freedom  
## Multiple R-squared: 0.4527, Adjusted R-squared: 0.4504   
## F-statistic: 203.9 on 2 and 493 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -20.1919 135.9047 203.8565   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

summary(ur.df(diffVSC, type="trend", lag=0))

##   
## ###############################################   
## # Augmented Dickey-Fuller Test Unit Root Test #   
## ###############################################   
##   
## Test regression trend   
##   
##   
## Call:  
## lm(formula = z.diff ~ z.lag.1 + 1 + tt)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1390.30 -184.16 -12.13 188.84 1401.29   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 17.38618 34.40900 0.505 0.614   
## z.lag.1 -0.99408 0.04505 -22.065 <2e-16 \*\*\*  
## tt -0.08019 0.12000 -0.668 0.504   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 382.5 on 493 degrees of freedom  
## Multiple R-squared: 0.4969, Adjusted R-squared: 0.4948   
## F-statistic: 243.4 on 2 and 493 DF, p-value: < 2.2e-16  
##   
##   
## Value of test-statistic is: -22.0653 162.2943 243.4412   
##   
## Critical values for test statistics:   
## 1pct 5pct 10pct  
## tau3 -3.98 -3.42 -3.13  
## phi2 6.15 4.71 4.05  
## phi3 8.34 6.30 5.36

#4 chuỗi giá dừng sai phân bậc 1, đủ điều kiện thực hiện kiểm định đồng tích hợp  
  
  
  
  
#Kiểm định đồng tích hợp của Johansen  
#Kiểm định với tiêu chí Trace  
summary(ca.jo(data.frame(AGR, SHS, VOS, VSC),type = "trace"))

##   
## ######################   
## # Johansen-Procedure #   
## ######################   
##   
## Test type: trace statistic , with linear trend   
##   
## Eigenvalues (lambda):  
## [1] 0.051870920 0.021313996 0.016642531 0.005380614  
##   
## Values of teststatistic and critical values of test:  
##   
## test 10pct 5pct 1pct  
## r <= 3 | 2.68 6.50 8.18 11.65  
## r <= 2 | 11.00 15.66 17.95 23.52  
## r <= 1 | 21.69 28.71 31.52 37.22  
## r = 0 | 48.11 45.23 48.28 55.43  
##   
## Eigenvectors, normalised to first column:  
## (These are the cointegration relations)  
##   
## AGR.l2 SHS.l2 VOS.l2 VSC.l2  
## AGR.l2 1.0000000 1.0000000 1.0000000 1.000000  
## SHS.l2 -0.9515604 -0.6947082 0.6120923 -6.658217  
## VOS.l2 -0.3912277 -1.5004238 -0.1717297 4.189364  
## VSC.l2 0.4340035 -0.3690256 -2.7689933 -9.727452  
##   
## Weights W:  
## (This is the loading matrix)  
##   
## AGR.l2 SHS.l2 VOS.l2 VSC.l2  
## AGR.d -0.0544770680 0.007371752 -0.002777319 -0.0004977594  
## SHS.d 0.0079704040 0.017640471 -0.004120622 0.0002910689  
## VOS.d -0.0005024295 0.010892856 0.004915986 -0.0006165733  
## VSC.d -0.0331233622 0.007284189 0.006830847 0.0001306458

#Kiểm định với tiêu chí Eigen  
summary(ca.jo(data.frame(AGR, SHS, VOS, VSC),type = "eigen"))

##   
## ######################   
## # Johansen-Procedure #   
## ######################   
##   
## Test type: maximal eigenvalue statistic (lambda max) , with linear trend   
##   
## Eigenvalues (lambda):  
## [1] 0.051870920 0.021313996 0.016642531 0.005380614  
##   
## Values of teststatistic and critical values of test:  
##   
## test 10pct 5pct 1pct  
## r <= 3 | 2.68 6.50 8.18 11.65  
## r <= 2 | 8.32 12.91 14.90 19.19  
## r <= 1 | 10.69 18.90 21.07 25.75  
## r = 0 | 26.42 24.78 27.14 32.14  
##   
## Eigenvectors, normalised to first column:  
## (These are the cointegration relations)  
##   
## AGR.l2 SHS.l2 VOS.l2 VSC.l2  
## AGR.l2 1.0000000 1.0000000 1.0000000 1.000000  
## SHS.l2 -0.9515604 -0.6947082 0.6120923 -6.658217  
## VOS.l2 -0.3912277 -1.5004238 -0.1717297 4.189364  
## VSC.l2 0.4340035 -0.3690256 -2.7689933 -9.727452  
##   
## Weights W:  
## (This is the loading matrix)  
##   
## AGR.l2 SHS.l2 VOS.l2 VSC.l2  
## AGR.d -0.0544770680 0.007371752 -0.002777319 -0.0004977594  
## SHS.d 0.0079704040 0.017640471 -0.004120622 0.0002910689  
## VOS.d -0.0005024295 0.010892856 0.004915986 -0.0006165733  
## VSC.d -0.0331233622 0.007284189 0.006830847 0.0001306458

#Không có đồng tích hợp giữa các chuỗi giá  
  
  
  
return=read\_excel("E:/NEU SLIDE/TIMES SERIES/Book3.xlsx")

## New names:  
## • `` -> `...5`  
## • `` -> `...6`  
## • `` -> `...7`  
## • `` -> `...8`  
## • `` -> `...9`  
## • `` -> `...10`

return=ts(return, start=1)  
return=data.frame(return)  
  
rAGR=return$rAGR  
rSHS=return$rSHS  
rVOS=return$rVOS  
rVSC=return$rVSC  
  
#Kiểm định Granger  
#AGR  
grangertest(rAGR, rSHS, order = 1)

## Granger causality test  
##   
## Model 1: rSHS ~ Lags(rSHS, 1:1) + Lags(rAGR, 1:1)  
## Model 2: rSHS ~ Lags(rSHS, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 2.6031 0.1073

grangertest(rAGR, rSHS, order = 2)

## Granger causality test  
##   
## Model 1: rSHS ~ Lags(rSHS, 1:2) + Lags(rAGR, 1:2)  
## Model 2: rSHS ~ Lags(rSHS, 1:2)  
## Res.Df Df F Pr(>F)   
## 1 490   
## 2 492 -2 2.829 0.06004 .  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

grangertest(rAGR, rVOS, order = 1)

## Granger causality test  
##   
## Model 1: rVOS ~ Lags(rVOS, 1:1) + Lags(rAGR, 1:1)  
## Model 2: rVOS ~ Lags(rVOS, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 1.1191 0.2906

grangertest(rAGR, rVOS, order = 2)

## Granger causality test  
##   
## Model 1: rVOS ~ Lags(rVOS, 1:2) + Lags(rAGR, 1:2)  
## Model 2: rVOS ~ Lags(rVOS, 1:2)  
## Res.Df Df F Pr(>F)   
## 1 490   
## 2 492 -2 4.9034 0.007789 \*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

grangertest(rAGR, rVSC, order = 1)

## Granger causality test  
##   
## Model 1: rVSC ~ Lags(rVSC, 1:1) + Lags(rAGR, 1:1)  
## Model 2: rVSC ~ Lags(rVSC, 1:1)  
## Res.Df Df F Pr(>F)   
## 1 493   
## 2 494 -1 12.697 0.0004019 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

grangertest(rAGR, rVSC, order = 2)

## Granger causality test  
##   
## Model 1: rVSC ~ Lags(rVSC, 1:2) + Lags(rAGR, 1:2)  
## Model 2: rVSC ~ Lags(rVSC, 1:2)  
## Res.Df Df F Pr(>F)   
## 1 490   
## 2 492 -2 7.2882 0.0007602 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

#SHS  
grangertest(rSHS, rAGR, order = 1)

## Granger causality test  
##   
## Model 1: rAGR ~ Lags(rAGR, 1:1) + Lags(rSHS, 1:1)  
## Model 2: rAGR ~ Lags(rAGR, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 1.5363 0.2158

grangertest(rSHS, rAGR, order = 2)

## Granger causality test  
##   
## Model 1: rAGR ~ Lags(rAGR, 1:2) + Lags(rSHS, 1:2)  
## Model 2: rAGR ~ Lags(rAGR, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 2.0023 0.1361

grangertest(rSHS, rVOS, order = 1)

## Granger causality test  
##   
## Model 1: rVOS ~ Lags(rVOS, 1:1) + Lags(rSHS, 1:1)  
## Model 2: rVOS ~ Lags(rVOS, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 0.5241 0.4695

grangertest(rSHS, rVOS, order = 2)

## Granger causality test  
##   
## Model 1: rVOS ~ Lags(rVOS, 1:2) + Lags(rSHS, 1:2)  
## Model 2: rVOS ~ Lags(rVOS, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 0.4137 0.6614

grangertest(rSHS, rVSC, order = 1)

## Granger causality test  
##   
## Model 1: rVSC ~ Lags(rVSC, 1:1) + Lags(rSHS, 1:1)  
## Model 2: rVSC ~ Lags(rVSC, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 0.0761 0.7827

grangertest(rSHS, rVSC, order = 2)

## Granger causality test  
##   
## Model 1: rVSC ~ Lags(rVSC, 1:2) + Lags(rSHS, 1:2)  
## Model 2: rVSC ~ Lags(rVSC, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 0.2188 0.8036

#VOS  
grangertest(rVOS, rAGR, order = 1)

## Granger causality test  
##   
## Model 1: rAGR ~ Lags(rAGR, 1:1) + Lags(rVOS, 1:1)  
## Model 2: rAGR ~ Lags(rAGR, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 0.9786 0.323

grangertest(rVOS, rAGR, order = 2)

## Granger causality test  
##   
## Model 1: rAGR ~ Lags(rAGR, 1:2) + Lags(rVOS, 1:2)  
## Model 2: rAGR ~ Lags(rAGR, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 0.7426 0.4764

grangertest(rVOS, rSHS, order = 1)

## Granger causality test  
##   
## Model 1: rSHS ~ Lags(rSHS, 1:1) + Lags(rVOS, 1:1)  
## Model 2: rSHS ~ Lags(rSHS, 1:1)  
## Res.Df Df F Pr(>F)   
## 1 493   
## 2 494 -1 7.6555 0.005873 \*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

grangertest(rVOS, rSHS, order = 2)

## Granger causality test  
##   
## Model 1: rSHS ~ Lags(rSHS, 1:2) + Lags(rVOS, 1:2)  
## Model 2: rSHS ~ Lags(rSHS, 1:2)  
## Res.Df Df F Pr(>F)   
## 1 490   
## 2 492 -2 4.2782 0.01439 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

grangertest(rVOS, rVSC, order = 1)

## Granger causality test  
##   
## Model 1: rVSC ~ Lags(rVSC, 1:1) + Lags(rVOS, 1:1)  
## Model 2: rVSC ~ Lags(rVSC, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 0.3143 0.5753

grangertest(rVOS, rVSC, order = 2)

## Granger causality test  
##   
## Model 1: rVSC ~ Lags(rVSC, 1:2) + Lags(rVOS, 1:2)  
## Model 2: rVSC ~ Lags(rVSC, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 0.4449 0.6411

#VCS  
grangertest(rVSC, rAGR, order = 1)

## Granger causality test  
##   
## Model 1: rAGR ~ Lags(rAGR, 1:1) + Lags(rVSC, 1:1)  
## Model 2: rAGR ~ Lags(rAGR, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 1.2165 0.2706

grangertest(rVSC, rAGR, order = 2)

## Granger causality test  
##   
## Model 1: rAGR ~ Lags(rAGR, 1:2) + Lags(rVSC, 1:2)  
## Model 2: rAGR ~ Lags(rAGR, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 0.1818 0.8339

grangertest(rVSC, rSHS, order = 1)

## Granger causality test  
##   
## Model 1: rSHS ~ Lags(rSHS, 1:1) + Lags(rVSC, 1:1)  
## Model 2: rSHS ~ Lags(rSHS, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 1.6758 0.1961

grangertest(rVSC, rSHS, order = 2)

## Granger causality test  
##   
## Model 1: rSHS ~ Lags(rSHS, 1:2) + Lags(rVSC, 1:2)  
## Model 2: rSHS ~ Lags(rSHS, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 1.5986 0.2032

grangertest(rVSC, rVOS, order = 1)

## Granger causality test  
##   
## Model 1: rVOS ~ Lags(rVOS, 1:1) + Lags(rVSC, 1:1)  
## Model 2: rVOS ~ Lags(rVOS, 1:1)  
## Res.Df Df F Pr(>F)  
## 1 493   
## 2 494 -1 0.0491 0.8247

grangertest(rVSC, rVOS, order = 2)

## Granger causality test  
##   
## Model 1: rVOS ~ Lags(rVOS, 1:2) + Lags(rVSC, 1:2)  
## Model 2: rVOS ~ Lags(rVOS, 1:2)  
## Res.Df Df F Pr(>F)  
## 1 490   
## 2 492 -2 0.8605 0.4236

#VAR  
data\_var <- data.frame(rAGR, rSHS, rVOS, rVSC)  
VARselect(data\_var)

## $selection  
## AIC(n) HQ(n) SC(n) FPE(n)   
## 6 1 1 6   
##   
## $criteria  
## 1 2 3 4 5 6  
## AIC(n) 7.210828 7.228952 7.237480 7.260081 7.262284 7.085508  
## HQ(n) 7.278397 7.350577 7.413160 7.489816 7.546075 7.423354  
## SC(n) 7.382831 7.538557 7.684687 7.844890 7.984696 7.945522  
## FPE(n) 1354.017097 1378.800665 1390.656300 1422.533388 1425.814542 1194.962029  
## 7 8 9 10  
## AIC(n) 7.110193 7.134659 7.144041 7.178602  
## HQ(n) 7.502094 7.580616 7.644052 7.732669  
## SC(n) 8.107808 8.269877 8.416860 8.589023  
## FPE(n) 1225.074508 1255.753613 1268.022709 1313.170660

#Tiêu chí AIC và FPE chọn p=6  
#Tiêu chí HQ và SC chọn p=1  
  
  
#VAR với p=6  
var\_model1 <- VAR(data\_var, p = 6, type = "const")  
summary(var\_model1)

##   
## VAR Estimation Results:  
## =========================   
## Endogenous variables: rAGR, rSHS, rVOS, rVSC   
## Deterministic variables: const   
## Sample size: 491   
## Log Likelihood: -4420.935   
## Roots of the characteristic polynomial:  
## 0.8233 0.8233 0.8065 0.8065 0.8037 0.8037 0.7681 0.7681 0.7242 0.7242 0.7162 0.7162 0.6412 0.6412 0.639 0.639 0.6212 0.6212 0.5743 0.5743 0.5495 0.5495 0.5426 0.01191  
## Call:  
## VAR(y = data\_var, p = 6, type = "const")  
##   
##   
## Estimation results for equation rAGR:   
## =====================================   
## rAGR = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + rAGR.l2 + rSHS.l2 + rVOS.l2 + rVSC.l2 + rAGR.l3 + rSHS.l3 + rVOS.l3 + rVSC.l3 + rAGR.l4 + rSHS.l4 + rVOS.l4 + rVSC.l4 + rAGR.l5 + rSHS.l5 + rVOS.l5 + rVSC.l5 + rAGR.l6 + rSHS.l6 + rVOS.l6 + rVSC.l6 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## rAGR.l1 -0.18529 0.04834 -3.834 0.000144 \*\*\*  
## rSHS.l1 -0.08404 0.04575 -1.837 0.066862 .   
## rVOS.l1 0.03298 0.05014 0.658 0.511009   
## rVSC.l1 0.01067 0.06693 0.159 0.873436   
## rAGR.l2 0.11116 0.04961 2.240 0.025536 \*   
## rSHS.l2 -0.06598 0.04544 -1.452 0.147189   
## rVOS.l2 -0.00702 0.05045 -0.139 0.889392   
## rVSC.l2 -0.02139 0.06694 -0.320 0.749457   
## rAGR.l3 -0.05071 0.04964 -1.022 0.307445   
## rSHS.l3 0.18155 0.04555 3.986 7.81e-05 \*\*\*  
## rVOS.l3 -0.11887 0.05079 -2.340 0.019685 \*   
## rVSC.l3 0.00716 0.06681 0.107 0.914704   
## rAGR.l4 -0.05660 0.04909 -1.153 0.249549   
## rSHS.l4 0.05697 0.04584 1.243 0.214539   
## rVOS.l4 0.17308 0.05111 3.386 0.000768 \*\*\*  
## rVSC.l4 -0.09718 0.06696 -1.451 0.147408   
## rAGR.l5 -0.02124 0.04900 -0.433 0.664952   
## rSHS.l5 0.14204 0.04597 3.090 0.002122 \*\*   
## rVOS.l5 -0.04913 0.05127 -0.958 0.338406   
## rVSC.l5 0.22446 0.06654 3.373 0.000805 \*\*\*  
## rAGR.l6 -0.06417 0.04765 -1.347 0.178717   
## rSHS.l6 0.44022 0.04563 9.648 < 2e-16 \*\*\*  
## rVOS.l6 -0.08540 0.05094 -1.677 0.094307 .   
## rVSC.l6 0.01501 0.06591 0.228 0.819959   
## const 0.15023 0.11965 1.256 0.209886   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 2.605 on 466 degrees of freedom  
## Multiple R-Squared: 0.2766, Adjusted R-squared: 0.2394   
## F-statistic: 7.426 on 24 and 466 DF, p-value: < 2.2e-16   
##   
##   
## Estimation results for equation rSHS:   
## =====================================   
## rSHS = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + rAGR.l2 + rSHS.l2 + rVOS.l2 + rVSC.l2 + rAGR.l3 + rSHS.l3 + rVOS.l3 + rVSC.l3 + rAGR.l4 + rSHS.l4 + rVOS.l4 + rVSC.l4 + rAGR.l5 + rSHS.l5 + rVOS.l5 + rVSC.l5 + rAGR.l6 + rSHS.l6 + rVOS.l6 + rVSC.l6 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## rAGR.l1 0.019262 0.049697 0.388 0.6985   
## rSHS.l1 -0.064137 0.047043 -1.363 0.1734   
## rVOS.l1 -0.125551 0.051556 -2.435 0.0153 \*  
## rVSC.l1 -0.028298 0.068815 -0.411 0.6811   
## rAGR.l2 0.079117 0.051012 1.551 0.1216   
## rSHS.l2 0.005702 0.046726 0.122 0.9029   
## rVOS.l2 0.011419 0.051868 0.220 0.8258   
## rVSC.l2 0.013471 0.068831 0.196 0.8449   
## rAGR.l3 0.050948 0.051035 0.998 0.3186   
## rSHS.l3 -0.049716 0.046836 -1.061 0.2890   
## rVOS.l3 -0.055133 0.052224 -1.056 0.2917   
## rVSC.l3 0.079709 0.068692 1.160 0.2465   
## rAGR.l4 -0.027385 0.050478 -0.543 0.5877   
## rSHS.l4 -0.054628 0.047131 -1.159 0.2470   
## rVOS.l4 0.073934 0.052550 1.407 0.1601   
## rVSC.l4 -0.011473 0.068852 -0.167 0.8677   
## rAGR.l5 -0.032457 0.050384 -0.644 0.5198   
## rSHS.l5 0.070762 0.047266 1.497 0.1350   
## rVOS.l5 -0.126745 0.052711 -2.405 0.0166 \*  
## rVSC.l5 0.071365 0.068417 1.043 0.2974   
## rAGR.l6 -0.027044 0.048990 -0.552 0.5812   
## rSHS.l6 0.007304 0.046913 0.156 0.8763   
## rVOS.l6 -0.032817 0.052376 -0.627 0.5313   
## rVSC.l6 -0.037620 0.067763 -0.555 0.5790   
## const 0.088075 0.123017 0.716 0.4744   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 2.679 on 466 degrees of freedom  
## Multiple R-Squared: 0.07497, Adjusted R-squared: 0.02733   
## F-statistic: 1.574 on 24 and 466 DF, p-value: 0.04216   
##   
##   
## Estimation results for equation rVOS:   
## =====================================   
## rVOS = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + rAGR.l2 + rSHS.l2 + rVOS.l2 + rVSC.l2 + rAGR.l3 + rSHS.l3 + rVOS.l3 + rVSC.l3 + rAGR.l4 + rSHS.l4 + rVOS.l4 + rVSC.l4 + rAGR.l5 + rSHS.l5 + rVOS.l5 + rVSC.l5 + rAGR.l6 + rSHS.l6 + rVOS.l6 + rVSC.l6 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## rAGR.l1 0.060043 0.049950 1.202 0.2300   
## rSHS.l1 0.001914 0.047283 0.040 0.9677   
## rVOS.l1 0.055164 0.051819 1.065 0.2876   
## rVSC.l1 -0.037388 0.069166 -0.541 0.5891   
## rAGR.l2 0.117484 0.051272 2.291 0.0224 \*   
## rSHS.l2 -0.030861 0.046964 -0.657 0.5114   
## rVOS.l2 -0.080446 0.052132 -1.543 0.1235   
## rVSC.l2 0.041257 0.069181 0.596 0.5512   
## rAGR.l3 -0.088160 0.051295 -1.719 0.0863 .   
## rSHS.l3 0.051765 0.047075 1.100 0.2721   
## rVOS.l3 0.074056 0.052490 1.411 0.1590   
## rVSC.l3 -0.044807 0.069041 -0.649 0.5167   
## rAGR.l4 -0.007794 0.050735 -0.154 0.8780   
## rSHS.l4 -0.036319 0.047371 -0.767 0.4437   
## rVOS.l4 0.116950 0.052818 2.214 0.0273 \*   
## rVSC.l4 -0.097419 0.069202 -1.408 0.1599   
## rAGR.l5 0.077858 0.050641 1.537 0.1249   
## rSHS.l5 0.061016 0.047507 1.284 0.1997   
## rVOS.l5 -0.073858 0.052979 -1.394 0.1640   
## rVSC.l5 0.137147 0.068765 1.994 0.0467 \*   
## rAGR.l6 -0.085773 0.049239 -1.742 0.0822 .   
## rSHS.l6 0.357912 0.047152 7.591 1.75e-13 \*\*\*  
## rVOS.l6 -0.047648 0.052643 -0.905 0.3659   
## rVSC.l6 0.108796 0.068108 1.597 0.1109   
## const 0.054641 0.123643 0.442 0.6588   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 2.692 on 466 degrees of freedom  
## Multiple R-Squared: 0.1667, Adjusted R-squared: 0.1238   
## F-statistic: 3.884 on 24 and 466 DF, p-value: 4.598e-09   
##   
##   
## Estimation results for equation rVSC:   
## =====================================   
## rVSC = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + rAGR.l2 + rSHS.l2 + rVOS.l2 + rVSC.l2 + rAGR.l3 + rSHS.l3 + rVOS.l3 + rVSC.l3 + rAGR.l4 + rSHS.l4 + rVOS.l4 + rVSC.l4 + rAGR.l5 + rSHS.l5 + rVOS.l5 + rVSC.l5 + rAGR.l6 + rSHS.l6 + rVOS.l6 + rVSC.l6 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## rAGR.l1 0.120477 0.037023 3.254 0.00122 \*\*   
## rSHS.l1 -0.006699 0.035046 -0.191 0.84849   
## rVOS.l1 -0.023269 0.038408 -0.606 0.54491   
## rVSC.l1 -0.058842 0.051265 -1.148 0.25164   
## rAGR.l2 0.022571 0.038002 0.594 0.55284   
## rSHS.l2 -0.004043 0.034809 -0.116 0.90759   
## rVOS.l2 0.049410 0.038640 1.279 0.20163   
## rVSC.l2 -0.049652 0.051277 -0.968 0.33339   
## rAGR.l3 -0.048351 0.038019 -1.272 0.20409   
## rSHS.l3 0.043316 0.034891 1.241 0.21506   
## rVOS.l3 0.016997 0.038905 0.437 0.66241   
## rVSC.l3 -0.035355 0.051173 -0.691 0.48998   
## rAGR.l4 -0.029518 0.037605 -0.785 0.43288   
## rSHS.l4 0.013204 0.035111 0.376 0.70704   
## rVOS.l4 0.025898 0.039148 0.662 0.50859   
## rVSC.l4 -0.071779 0.051292 -1.399 0.16236   
## rAGR.l5 0.028058 0.037535 0.748 0.45513   
## rSHS.l5 0.052412 0.035212 1.488 0.13730   
## rVOS.l5 -0.029085 0.039268 -0.741 0.45927   
## rVSC.l5 0.038648 0.050968 0.758 0.44866   
## rAGR.l6 -0.005622 0.036496 -0.154 0.87763   
## rSHS.l6 0.201144 0.034949 5.755 1.57e-08 \*\*\*  
## rVOS.l6 -0.027971 0.039018 -0.717 0.47381   
## rVSC.l6 -0.002279 0.050482 -0.045 0.96401   
## const -0.057963 0.091644 -0.632 0.52738   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 1.996 on 466 degrees of freedom  
## Multiple R-Squared: 0.1125, Adjusted R-squared: 0.0668   
## F-statistic: 2.462 on 24 and 466 DF, p-value: 0.0001718   
##   
##   
##   
## Covariance matrix of residuals:  
## rAGR rSHS rVOS rVSC  
## rAGR 6.788 1.1096 2.483 1.5965  
## rSHS 1.110 7.1759 1.167 0.1944  
## rVOS 2.483 1.1672 7.249 2.1192  
## rVSC 1.597 0.1944 2.119 3.9825  
##   
## Correlation matrix of residuals:  
## rAGR rSHS rVOS rVSC  
## rAGR 1.0000 0.15899 0.3540 0.30706  
## rSHS 0.1590 1.00000 0.1618 0.03637  
## rVOS 0.3540 0.16183 1.0000 0.39441  
## rVSC 0.3071 0.03637 0.3944 1.00000

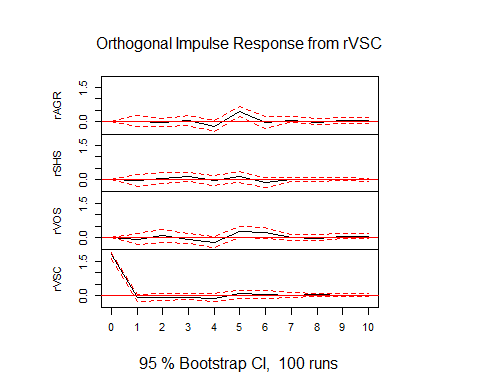
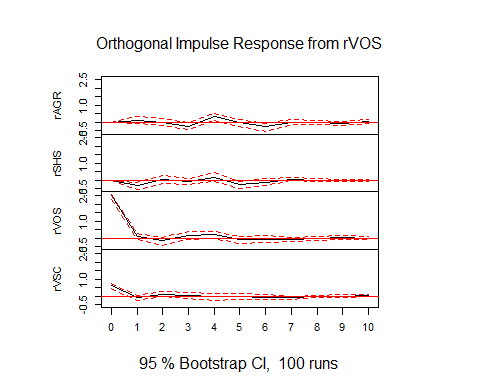
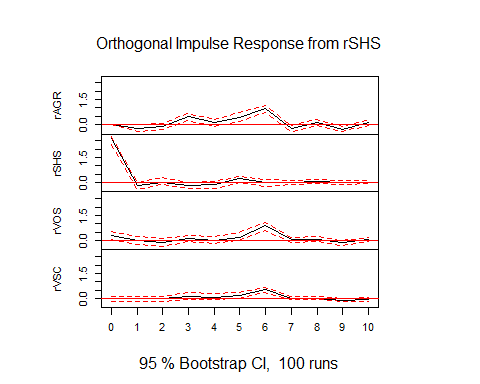
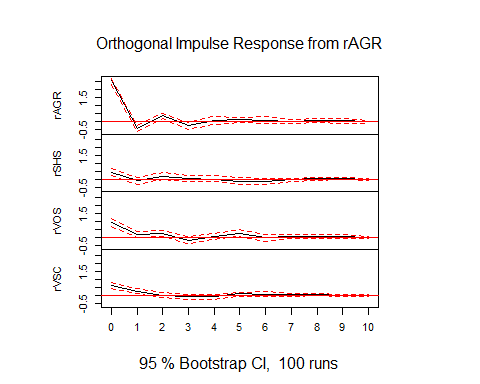
#VAR với p=1  
var\_model2 <- VAR(data\_var, p = 1, type = "const")  
summary(var\_model2)

##   
## VAR Estimation Results:  
## =========================   
## Endogenous variables: rAGR, rSHS, rVOS, rVSC   
## Deterministic variables: const   
## Sample size: 496   
## Log Likelihood: -4577.399   
## Roots of the characteristic polynomial:  
## 0.232 0.05612 0.03834 0.03834  
## Call:  
## VAR(y = data\_var, p = 1, type = "const")  
##   
##   
## Estimation results for equation rAGR:   
## =====================================   
## rAGR = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## rAGR.l1 -0.18668 0.05028 -3.713 0.000228 \*\*\*  
## rSHS.l1 -0.06349 0.04983 -1.274 0.203236   
## rVOS.l1 0.04160 0.05430 0.766 0.443952   
## rVSC.l1 0.05296 0.07284 0.727 0.467530   
## const 0.18254 0.13229 1.380 0.168256   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 2.941 on 491 degrees of freedom  
## Multiple R-Squared: 0.03431, Adjusted R-squared: 0.02644   
## F-statistic: 4.361 on 4 and 491 DF, p-value: 0.001788   
##   
##   
## Estimation results for equation rSHS:   
## =====================================   
## rSHS = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## rAGR.l1 -0.0241214 0.0458938 -0.526 0.5994   
## rSHS.l1 -0.0638007 0.0454871 -1.403 0.1614   
## rVOS.l1 -0.1069463 0.0495670 -2.158 0.0314 \*  
## rVSC.l1 0.0008282 0.0664884 0.012 0.9901   
## const 0.0874781 0.1207525 0.724 0.4691   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 2.684 on 491 degrees of freedom  
## Multiple R-Squared: 0.02292, Adjusted R-squared: 0.01496   
## F-statistic: 2.879 on 4 and 491 DF, p-value: 0.02237   
##   
##   
## Estimation results for equation rVOS:   
## =====================================   
## rVOS = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)  
## rAGR.l1 0.046505 0.049213 0.945 0.345  
## rSHS.l1 0.029359 0.048777 0.602 0.548  
## rVOS.l1 0.056992 0.053152 1.072 0.284  
## rVSC.l1 0.004449 0.071297 0.062 0.950  
## const 0.060551 0.129485 0.468 0.640  
##   
##   
## Residual standard error: 2.878 on 491 degrees of freedom  
## Multiple R-Squared: 0.009831, Adjusted R-squared: 0.001765   
## F-statistic: 1.219 on 4 and 491 DF, p-value: 0.3019   
##   
##   
## Estimation results for equation rVSC:   
## =====================================   
## rVSC = rAGR.l1 + rSHS.l1 + rVOS.l1 + rVSC.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## rAGR.l1 0.124847 0.034948 3.572 0.000389 \*\*\*  
## rSHS.l1 -0.009424 0.034638 -0.272 0.785689   
## rVOS.l1 -0.022499 0.037745 -0.596 0.551403   
## rVSC.l1 -0.042580 0.050630 -0.841 0.400759   
## const -0.032347 0.091952 -0.352 0.725156   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 2.044 on 491 degrees of freedom  
## Multiple R-Squared: 0.02605, Adjusted R-squared: 0.01811   
## F-statistic: 3.283 on 4 and 491 DF, p-value: 0.01134   
##   
##   
##   
## Covariance matrix of residuals:  
## rAGR rSHS rVOS rVSC  
## rAGR 8.648 1.2683 3.783 2.2719  
## rSHS 1.268 7.2058 1.248 0.2084  
## rVOS 3.783 1.2481 8.286 2.5882  
## rVSC 2.272 0.2084 2.588 4.1784  
##   
## Correlation matrix of residuals:  
## rAGR rSHS rVOS rVSC  
## rAGR 1.0000 0.16067 0.4468 0.37794  
## rSHS 0.1607 1.00000 0.1615 0.03798  
## rVOS 0.4468 0.16153 1.0000 0.43988  
## rVSC 0.3779 0.03798 0.4399 1.00000

#Kiểm định tự tương quan của phần dư  
serial.test(var\_model2)

##   
## Portmanteau Test (asymptotic)  
##   
## data: Residuals of VAR object var\_model2  
## Chi-squared = 390.56, df = 240, p-value = 2.712e-09

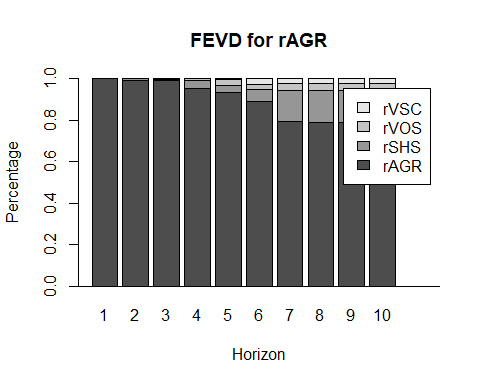
#hàm phản ứng  
irf1=irf(var\_model1)  
plot(irf1)



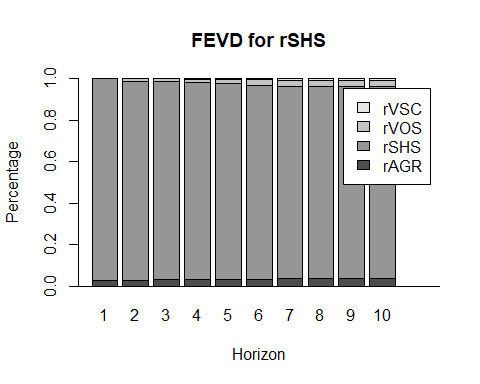
#Phân rã phương sai  
fedv1=fevd(var\_model1)  
print(fedv1)

## $rAGR  
## rAGR rSHS rVOS rVSC  
## [1,] 1.0000000 0.000000000 0.000000000 0.0000000000  
## [2,] 0.9924082 0.006417815 0.001122094 0.0000519077  
## [3,] 0.9903242 0.008252429 0.001138878 0.0002845403  
## [4,] 0.9544402 0.034824856 0.010367416 0.0003675379  
## [5,] 0.9333426 0.035210720 0.025785586 0.0056610595  
## [6,] 0.8902972 0.057172042 0.024854625 0.0276761421  
## [7,] 0.7928775 0.151876919 0.030402586 0.0248429803  
## [8,] 0.7878227 0.156841492 0.030317178 0.0250186268  
## [9,] 0.7865861 0.158093436 0.030266668 0.0250538204  
## [10,] 0.7784430 0.166295941 0.030377451 0.0248835803  
##   
## $rSHS  
## rAGR rSHS rVOS rVSC  
## [1,] 0.02527800 0.9747220 0.00000000 0.0000000000  
## [2,] 0.02647546 0.9582065 0.01496625 0.0003518108  
## [3,] 0.03147857 0.9527699 0.01519315 0.0005583407  
## [4,] 0.03151360 0.9498500 0.01575001 0.0028863547  
## [5,] 0.03133017 0.9465236 0.01921134 0.0029349346  
## [6,] 0.03303446 0.9322611 0.02931781 0.0053866477  
## [7,] 0.03597563 0.9254745 0.03115800 0.0073918140  
## [8,] 0.03601534 0.9251002 0.03148304 0.0074013884  
## [9,] 0.03606232 0.9250372 0.03146986 0.0074306426  
## [10,] 0.03620860 0.9247067 0.03157748 0.0075072322  
##   
## $rVOS  
## rAGR rSHS rVOS rVSC  
## [1,] 0.1253367 0.01142882 0.8632345 0.0000000000  
## [2,] 0.1292093 0.01141121 0.8587619 0.0006175918  
## [3,] 0.1337772 0.01312043 0.8517233 0.0013790683  
## [4,] 0.1371313 0.01507571 0.8457558 0.0020372596  
## [5,] 0.1357783 0.01497912 0.8422258 0.0070168222  
## [6,] 0.1395591 0.02024063 0.8253205 0.0148797812  
## [7,] 0.1257178 0.11132533 0.7435921 0.0193647345  
## [8,] 0.1256316 0.11139399 0.7436351 0.0193393405  
## [9,] 0.1256994 0.11198795 0.7429063 0.0194062701  
## [10,] 0.1254618 0.11392860 0.7409314 0.0196782008  
##   
## $rVSC  
## rAGR rSHS rVOS rVSC  
## [1,] 0.09428856 0.0001589605 0.09544980 0.8101027  
## [2,] 0.10804218 0.0002849912 0.09566115 0.7960117  
## [3,] 0.10755720 0.0003690675 0.09812929 0.7939444  
## [4,] 0.10891270 0.0032004597 0.09774962 0.7901372  
## [5,] 0.10990776 0.0049376992 0.09750296 0.7876516  
## [6,] 0.11055063 0.0110320311 0.09666468 0.7817527  
## [7,] 0.10435463 0.0692533432 0.09198390 0.7344081  
## [8,] 0.10425145 0.0691376561 0.09343191 0.7331790  
## [9,] 0.10430870 0.0691194269 0.09344639 0.7331255  
## [10,] 0.10409756 0.0709951402 0.09325666 0.7316506

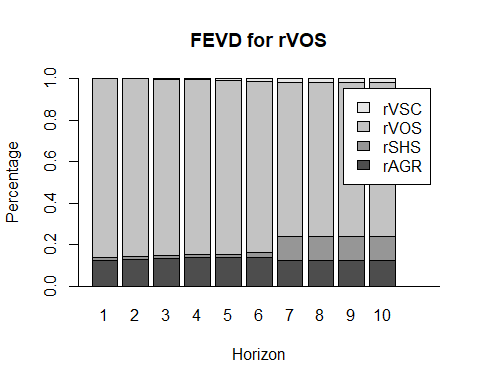
#Đồ thị phân rã phương sai  
plot(fedv1, names = "rAGR")



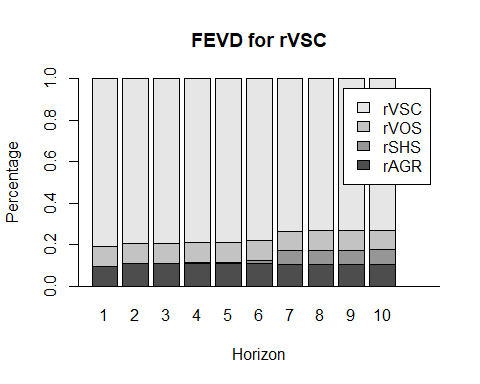
plot(fedv1, names = "rSHS")



plot(fedv1, names = "rVOS")



plot(fedv1, names = "rVSC")



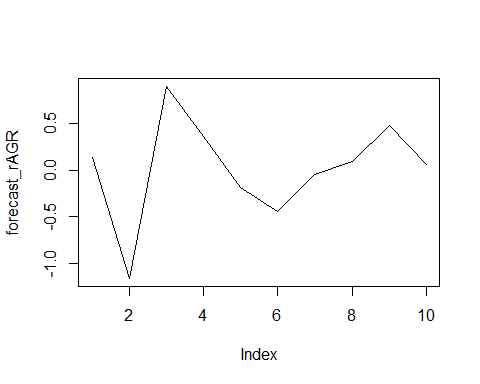
#Ước lượng với mô hình VAR  
forecast1 <-predict(var\_model1)  
print(forecast1)

## $rAGR  
## fcst lower upper CI  
## [1,] 0.14080350 -4.965636 5.247243 5.106439  
## [2,] -1.15733645 -6.369744 4.055071 5.212408  
## [3,] 0.89736174 -4.365658 6.160381 5.263020  
## [4,] 0.35622579 -5.036388 5.748840 5.392614  
## [5,] -0.18955663 -5.643190 5.264077 5.453633  
## [6,] -0.44432986 -6.030640 5.141981 5.586310  
## [7,] -0.04139168 -5.963077 5.880293 5.921685  
## [8,] 0.09011153 -5.850707 6.030930 5.940819  
## [9,] 0.48286939 -5.463015 6.428754 5.945884  
## [10,] 0.06217424 -5.914811 6.039159 5.976985  
##   
## $rSHS  
## fcst lower upper CI  
## [1,] -0.414241071 -5.664573 4.836090 5.250331  
## [2,] -0.331084772 -5.642362 4.980192 5.311277  
## [3,] 0.597284856 -4.729360 5.923930 5.326645  
## [4,] -0.003746176 -5.347803 5.340311 5.344057  
## [5,] -0.066811145 -5.427411 5.293789 5.360600  
## [6,] 0.260468936 -5.158521 5.679459 5.418990  
## [7,] 0.199840251 -5.238987 5.638668 5.438828  
## [8,] 0.096712446 -5.343369 5.536794 5.440081  
## [9,] -0.020783066 -5.463078 5.421512 5.442295  
## [10,] -0.028790664 -5.472293 5.414712 5.443503  
##   
## $rVOS  
## fcst lower upper CI  
## [1,] -0.806602159 -6.083668 4.470464 5.277066  
## [2,] -0.449305877 -5.745678 4.847067 5.296373  
## [3,] 0.405146467 -4.924075 5.734367 5.329221  
## [4,] 0.362243442 -4.995460 5.719947 5.357703  
## [5,] 0.122027955 -5.268437 5.512493 5.390465  
## [6,] -0.591289107 -6.039677 4.857099 5.448388  
## [7,] -0.291550162 -6.034427 5.451327 5.742877  
## [8,] 0.101505749 -5.646328 5.849339 5.747833  
## [9,] 0.268357133 -5.482435 6.019149 5.750792  
## [10,] 0.005152131 -5.753575 5.763879 5.758727  
##   
## $rVSC  
## fcst lower upper CI  
## [1,] -0.23256070 -4.143891 3.678770 3.911331  
## [2,] -0.33129194 -4.283915 3.621331 3.952623  
## [3,] 0.03627423 -3.925281 3.997829 3.961555  
## [4,] 0.25784366 -3.715693 4.231380 3.973537  
## [5,] 0.03187185 -3.956048 4.019792 3.987920  
## [6,] -0.32763222 -4.333452 3.678187 4.005820  
## [7,] -0.22140452 -4.355267 3.912458 4.133863  
## [8,] -0.08164381 -4.218998 4.055711 4.137354  
## [9,] 0.10232666 -4.035574 4.240227 4.137900  
## [10,] 0.01247237 -4.129650 4.154594 4.142122

# Dự báo điểm cho rAGR  
forecast\_rAGR <- forecast1$fcst$rAGR[, "fcst"]  
print(forecast\_rAGR)

## [1] 0.14080350 -1.15733645 0.89736174 0.35622579 -0.18955663 -0.44432986  
## [7] -0.04139168 0.09011153 0.48286939 0.06217424

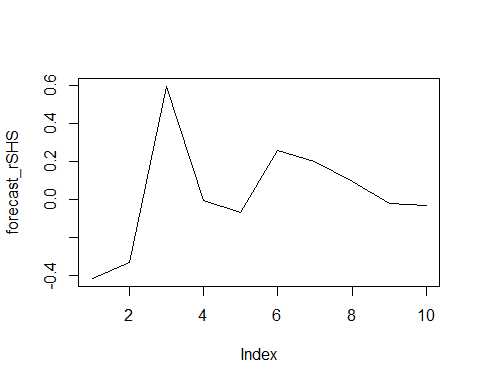
plot(forecast\_rAGR, type="l")



# Dự báo điểm cho rSHS  
forecast\_rSHS <- forecast1$fcst$rSHS[, "fcst"]  
print(forecast\_rSHS)

## [1] -0.414241071 -0.331084772 0.597284856 -0.003746176 -0.066811145  
## [6] 0.260468936 0.199840251 0.096712446 -0.020783066 -0.028790664

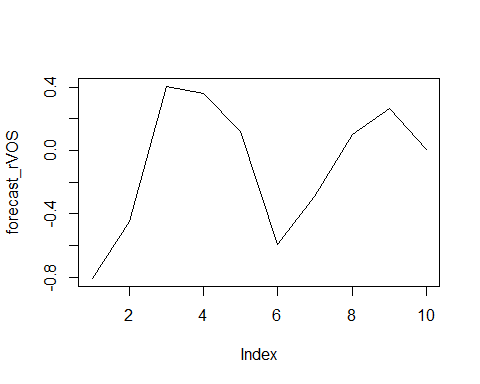
plot(forecast\_rSHS, type="l")



# Dự báo điểm cho rVOS  
forecast\_rVOS <- forecast1$fcst$rVOS[, "fcst"]  
print(forecast\_rVOS)

## [1] -0.806602159 -0.449305877 0.405146467 0.362243442 0.122027955  
## [6] -0.591289107 -0.291550162 0.101505749 0.268357133 0.005152131

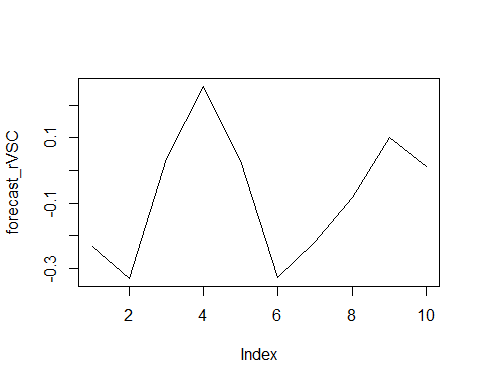
plot(forecast\_rVOS, type="l")



# Dự báo điểm cho rVSC  
forecast\_rVSC <- forecast1$fcst$rVSC[, "fcst"]  
print(forecast\_rVSC)

## [1] -0.23256070 -0.33129194 0.03627423 0.25784366 0.03187185 -0.32763222  
## [7] -0.22140452 -0.08164381 0.10232666 0.01247237

plot(forecast\_rVSC, type="l")



```