4차

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library(vars)

## Warning: 패키지 'vars'는 R 버전 4.3.3에서 작성되었습니다

## 필요한 패키지를 로딩중입니다: MASS

## 필요한 패키지를 로딩중입니다: strucchange

## Warning: 패키지 'strucchange'는 R 버전 4.3.3에서 작성되었습니다

## 필요한 패키지를 로딩중입니다: zoo

## Warning: 패키지 'zoo'는 R 버전 4.3.3에서 작성되었습니다

##   
## 다음의 패키지를 부착합니다: 'zoo'

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

## 필요한 패키지를 로딩중입니다: sandwich

## Warning: 패키지 'sandwich'는 R 버전 4.3.3에서 작성되었습니다

## 필요한 패키지를 로딩중입니다: urca

## Warning: 패키지 'urca'는 R 버전 4.3.3에서 작성되었습니다

## 필요한 패키지를 로딩중입니다: lmtest

## Warning: 패키지 'lmtest'는 R 버전 4.3.2에서 작성되었습니다

library(svars)

## Warning: 패키지 'svars'는 R 버전 4.3.3에서 작성되었습니다

## Registered S3 method overwritten by 'svars':  
## method from  
## stability.varest vars

library(readxl)

## Warning: 패키지 'readxl'는 R 버전 4.3.3에서 작성되었습니다

insurance = read\_excel("C:/temp/seed/insurance.xlsx")  
head(insurance)

## # A tibble: 6 × 9  
## date CD unemployment CCI CPI KOSPI whole annuity universal  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 2014… 0 -0.1 9.92e-4 4.15e-3 -0.0190 1.61e-3 -1.73e-3 -0.00127   
## 2 2014… 0 0.400 -2.99e-3 -2.70e-3 0.0553 1.48e-3 1.38e-3 0.00131   
## 3 2014… 0 -0.6 9.95e-4 -8.25e-4 -0.0170 -1.51e-3 1.43e-3 0.00041   
## 4 2014… 0 0.4 -2.98e-3 -1.19e-3 -0.0149 3.00e-5 -2.10e-3 -0.00171   
## 5 2014… 0 -0.3 -2.00e-3 9.96e-4 0.0288 -1.52e-3 7.00e-4 0.00109   
## 6 2014… 0 0.1 3.99e-3 -2.93e-3 -0.0131 4.51e-3 -3.40e-4 -0.000210

tail(insurance)

## # A tibble: 6 × 9  
## date CD unemployment CCI CPI KOSPI whole annuity  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 2022\_07 0.0743 0 0.000990 -0.00179 0.191 0.00143 1.12e-3  
## 2 2022\_08 -0.0451 -0.300 0.00197 -0.00571 -0.0414 0.0000100 -5.60e-4  
## 3 2022\_09 -0.0705 0.500 -0.00494 0.00267 -0.145 0.00145 -5.60e-4  
## 4 2022\_10 0.128 -0.200 -0.000000974 0.00137 0.199 -0.00291 2.79e-3  
## 5 2022\_11 -0.126 -0.100 -0.00397 -0.00394 0.0130 0.00292 2.28e-3  
## 6 2022\_12 -0.0707 0.400 -0.0000247 0.00257 -0.175 -0.00146 -6.63e-3  
## # ℹ 1 more variable: universal <dbl>

insurance = subset(insurance, select = -date)  
str(insurance)

## tibble [108 × 8] (S3: tbl\_df/tbl/data.frame)  
## $ CD : num [1:108] 0 0 0 0 0 ...  
## $ unemployment: num [1:108] -0.1 0.4 -0.6 0.4 -0.3 ...  
## $ CCI : num [1:108] 0.000992 -0.00299 0.000995 -0.002985 -0.002002 ...  
## $ CPI : num [1:108] 0.004147 -0.002696 -0.000825 -0.001191 0.000996 ...  
## $ KOSPI : num [1:108] -0.019 0.0553 -0.017 -0.0149 0.0288 ...  
## $ whole : num [1:108] 0.00161 0.00148 -0.00151 0.00003 -0.00152 ...  
## $ annuity : num [1:108] -0.00173 0.00138 0.00143 -0.0021 0.0007 ...  
## $ universal : num [1:108] -0.00127 0.00131 0.00041 -0.00171 0.00109 ...

insurance\_whole = subset(insurance, select = c(CD, unemployment, CCI, CPI, KOSPI, whole))  
head(insurance\_whole)

## # A tibble: 6 × 6  
## CD unemployment CCI CPI KOSPI whole  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 0 -0.1 0.000992 0.00415 -0.0190 0.00161   
## 2 0 0.400 -0.00299 -0.00270 0.0553 0.00148   
## 3 0 -0.6 0.000995 -0.000825 -0.0170 -0.00151   
## 4 0 0.4 -0.00298 -0.00119 -0.0149 0.0000300  
## 5 0 -0.3 -0.00200 0.000996 0.0288 -0.00152   
## 6 0 0.1 0.00399 -0.00293 -0.0131 0.00451

insurance\_annuity = subset(insurance, select = c(CD, unemployment, CCI, CPI, KOSPI, annuity))  
head(insurance\_annuity)

## # A tibble: 6 × 6  
## CD unemployment CCI CPI KOSPI annuity  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 0 -0.1 0.000992 0.00415 -0.0190 -0.00173   
## 2 0 0.400 -0.00299 -0.00270 0.0553 0.00138   
## 3 0 -0.6 0.000995 -0.000825 -0.0170 0.00143   
## 4 0 0.4 -0.00298 -0.00119 -0.0149 -0.00210   
## 5 0 -0.3 -0.00200 0.000996 0.0288 0.000700  
## 6 0 0.1 0.00399 -0.00293 -0.0131 -0.000340

insurance\_universal = subset(insurance, select = c(CD, unemployment, CCI, CPI, KOSPI, universal))  
head(insurance\_universal)

## # A tibble: 6 × 6  
## CD unemployment CCI CPI KOSPI universal  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 0 -0.1 0.000992 0.00415 -0.0190 -0.00127   
## 2 0 0.400 -0.00299 -0.00270 0.0553 0.00131   
## 3 0 -0.6 0.000995 -0.000825 -0.0170 0.00041   
## 4 0 0.4 -0.00298 -0.00119 -0.0149 -0.00171   
## 5 0 -0.3 -0.00200 0.000996 0.0288 0.00109   
## 6 0 0.1 0.00399 -0.00293 -0.0131 -0.000210

max\_lags = 12  
lag\_selection\_whole = VARselect(insurance\_whole, lag.max = max\_lags, type = "const")  
print(lag\_selection\_whole$selection)

## AIC(n) HQ(n) SC(n) FPE(n)   
## 12 12 1 12

lag\_selection\_annuity = VARselect(insurance\_annuity, lag.max = max\_lags, type = "const")  
print(lag\_selection\_annuity$selection)

## AIC(n) HQ(n) SC(n) FPE(n)   
## 12 12 1 12

lag\_selection\_universal = VARselect(insurance\_universal, lag.max = max\_lags, type = "const")  
print(lag\_selection\_universal$selection)

## AIC(n) HQ(n) SC(n) FPE(n)   
## 12 12 1 12

##최적시차 문제!!! 10~15사이에서 max\_lags를 설정했는데 max\_lags 값에 따라서 최적시차가 결정됨 -> 일관적이지 않음  
##그래서 우선 sc(n)은 계속 1이 나와서 p=1로 분석을 진행하긴 할건데 일관된 최적시차가 아니라서 이래도 될련지~

var\_model\_whole = VAR(insurance\_whole, p=1)  
summary(var\_model\_whole)

##   
## VAR Estimation Results:  
## =========================   
## Endogenous variables: CD, unemployment, CCI, CPI, KOSPI, whole   
## Deterministic variables: const   
## Sample size: 107   
## Log Likelihood: 1586.205   
## Roots of the characteristic polynomial:  
## 0.5927 0.5927 0.5021 0.3944 0.3944 0.1216  
## Call:  
## VAR(y = insurance\_whole, p = 1)  
##   
##   
## Estimation results for equation CD:   
## ===================================   
## CD = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + whole.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 -0.3925753 0.0947837 -4.142 7.21e-05 \*\*\*  
## unemployment.l1 0.0008732 0.0152177 0.057 0.954   
## CCI.l1 0.8624571 1.7212058 0.501 0.617   
## CPI.l1 -0.3850176 1.4020172 -0.275 0.784   
## KOSPI.l1 -0.0822362 0.0890453 -0.924 0.358   
## whole.l1 0.3664926 0.7186978 0.510 0.611   
## const 0.0004669 0.0057855 0.081 0.936   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.05982 on 100 degrees of freedom  
## Multiple R-Squared: 0.1774, Adjusted R-squared: 0.128   
## F-statistic: 3.593 on 6 and 100 DF, p-value: 0.00288   
##   
##   
## Estimation results for equation unemployment:   
## =============================================   
## unemployment = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + whole.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 -1.084637 0.499541 -2.171 0.0323 \*   
## unemployment.l1 -0.608760 0.080202 -7.590 1.71e-11 \*\*\*  
## CCI.l1 -0.567193 9.071326 -0.063 0.9503   
## CPI.l1 2.486536 7.389096 0.337 0.7372   
## KOSPI.l1 0.451510 0.469298 0.962 0.3383   
## whole.l1 -3.679004 3.787776 -0.971 0.3338   
## const 0.002189 0.030491 0.072 0.9429   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.3153 on 100 degrees of freedom  
## Multiple R-Squared: 0.3897, Adjusted R-squared: 0.3531   
## F-statistic: 10.64 on 6 and 100 DF, p-value: 4.051e-09   
##   
##   
## Estimation results for equation CCI:   
## ====================================   
## CCI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + whole.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 1.248e-02 5.321e-03 2.345 0.0210 \*  
## unemployment.l1 -4.865e-04 8.543e-04 -0.570 0.5703   
## CCI.l1 -1.877e-01 9.663e-02 -1.942 0.0549 .  
## CPI.l1 3.843e-02 7.871e-02 0.488 0.6264   
## KOSPI.l1 -3.301e-03 4.999e-03 -0.660 0.5105   
## whole.l1 4.335e-02 4.035e-02 1.075 0.2852   
## const -9.438e-05 3.248e-04 -0.291 0.7720   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.003358 on 100 degrees of freedom  
## Multiple R-Squared: 0.1091, Adjusted R-squared: 0.05563   
## F-statistic: 2.041 on 6 and 100 DF, p-value: 0.06711   
##   
##   
## Estimation results for equation CPI:   
## ====================================   
## CPI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + whole.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 7.378e-03 6.313e-03 1.169 0.2453   
## unemployment.l1 1.250e-03 1.014e-03 1.233 0.2205   
## CCI.l1 9.830e-02 1.146e-01 0.857 0.3932   
## CPI.l1 -2.446e-01 9.338e-02 -2.619 0.0102 \*  
## KOSPI.l1 6.960e-03 5.931e-03 1.173 0.2434   
## whole.l1 1.085e-01 4.787e-02 2.267 0.0255 \*  
## const -4.427e-05 3.854e-04 -0.115 0.9088   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.003985 on 100 degrees of freedom  
## Multiple R-Squared: 0.1344, Adjusted R-squared: 0.0825   
## F-statistic: 2.589 on 6 and 100 DF, p-value: 0.02255   
##   
##   
## Estimation results for equation KOSPI:   
## ======================================   
## KOSPI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + whole.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 0.1613471 0.0945846 1.706 0.0911 .   
## unemployment.l1 0.0117567 0.0151858 0.774 0.4406   
## CCI.l1 0.7863557 1.7175902 0.458 0.6481   
## CPI.l1 -1.2311697 1.3990721 -0.880 0.3810   
## KOSPI.l1 -0.5252122 0.0888582 -5.911 4.75e-08 \*\*\*  
## whole.l1 0.8839511 0.7171881 1.233 0.2206   
## const -0.0002503 0.0057733 -0.043 0.9655   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.0597 on 100 degrees of freedom  
## Multiple R-Squared: 0.2825, Adjusted R-squared: 0.2395   
## F-statistic: 6.563 on 6 and 100 DF, p-value: 7.21e-06   
##   
##   
## Estimation results for equation whole:   
## ======================================   
## whole = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + whole.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 1.871e-02 1.005e-02 1.862 0.0655 .   
## unemployment.l1 1.813e-03 1.613e-03 1.124 0.2638   
## CCI.l1 2.009e-01 1.825e-01 1.101 0.2736   
## CPI.l1 -2.014e-01 1.486e-01 -1.355 0.1783   
## KOSPI.l1 -4.079e-03 9.439e-03 -0.432 0.6666   
## whole.l1 -6.016e-01 7.618e-02 -7.897 3.78e-12 \*\*\*  
## const 2.044e-05 6.133e-04 0.033 0.9735   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.006342 on 100 degrees of freedom  
## Multiple R-Squared: 0.462, Adjusted R-squared: 0.4297   
## F-statistic: 14.31 on 6 and 100 DF, p-value: 1.029e-11   
##   
##   
##   
## Covariance matrix of residuals:  
## CD unemployment CCI CPI KOSPI  
## CD 3.579e-03 -2.868e-03 1.189e-06 -2.129e-05 4.399e-04  
## unemployment -2.868e-03 9.941e-02 -9.882e-05 2.090e-04 -6.791e-04  
## CCI 1.189e-06 -9.882e-05 1.128e-05 -5.426e-07 1.048e-05  
## CPI -2.129e-05 2.090e-04 -5.426e-07 1.588e-05 -1.272e-05  
## KOSPI 4.399e-04 -6.791e-04 1.048e-05 -1.272e-05 3.564e-03  
## whole -4.234e-05 -9.658e-05 -2.102e-06 2.801e-06 7.191e-06  
## whole  
## CD -4.234e-05  
## unemployment -9.658e-05  
## CCI -2.102e-06  
## CPI 2.801e-06  
## KOSPI 7.191e-06  
## whole 4.021e-05  
##   
## Correlation matrix of residuals:  
## CD unemployment CCI CPI KOSPI whole  
## CD 1.000000 -0.15207 0.005918 -0.08930 0.12318 -0.11160  
## unemployment -0.152073 1.00000 -0.093327 0.16638 -0.03608 -0.04831  
## CCI 0.005918 -0.09333 1.000000 -0.04055 0.05226 -0.09869  
## CPI -0.089299 0.16638 -0.040546 1.00000 -0.05349 0.11085  
## KOSPI 0.123183 -0.03608 0.052261 -0.05349 1.00000 0.01899  
## whole -0.111598 -0.04831 -0.098688 0.11085 0.01899 1.00000

var\_model\_annuity = VAR(insurance\_annuity, p=1)  
summary(var\_model\_annuity)

##   
## VAR Estimation Results:  
## =========================   
## Endogenous variables: CD, unemployment, CCI, CPI, KOSPI, annuity   
## Deterministic variables: const   
## Sample size: 107   
## Log Likelihood: 1626.283   
## Roots of the characteristic polynomial:  
## 0.6423 0.6423 0.455 0.3611 0.3611 0.1214  
## Call:  
## VAR(y = insurance\_annuity, p = 1)  
##   
##   
## Estimation results for equation CD:   
## ===================================   
## CD = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + annuity.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 -0.4060854 0.0931553 -4.359 3.17e-05 \*\*\*  
## unemployment.l1 -0.0001934 0.0151032 -0.013 0.990   
## CCI.l1 0.5878375 1.7762961 0.331 0.741   
## CPI.l1 -0.3831947 1.4032579 -0.273 0.785   
## KOSPI.l1 -0.0788260 0.0893838 -0.882 0.380   
## annuity.l1 -0.3102048 1.0706522 -0.290 0.773   
## const 0.0004767 0.0057905 0.082 0.935   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.05988 on 100 degrees of freedom  
## Multiple R-Squared: 0.1759, Adjusted R-squared: 0.1265   
## F-statistic: 3.558 on 6 and 100 DF, p-value: 0.003099   
##   
##   
## Estimation results for equation unemployment:   
## =============================================   
## unemployment = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + annuity.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 -0.976040 0.492829 -1.980 0.0504 .   
## unemployment.l1 -0.598578 0.079902 -7.491 2.77e-11 \*\*\*  
## CCI.l1 0.869798 9.397332 0.093 0.9264   
## CPI.l1 2.480836 7.423807 0.334 0.7389   
## KOSPI.l1 0.436421 0.472877 0.923 0.3583   
## annuity.l1 0.298105 5.664187 0.053 0.9581   
## const 0.002116 0.030634 0.069 0.9451   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.3168 on 100 degrees of freedom  
## Multiple R-Squared: 0.384, Adjusted R-squared: 0.347   
## F-statistic: 10.39 on 6 and 100 DF, p-value: 6.289e-09   
##   
##   
## Estimation results for equation CCI:   
## ====================================   
## CCI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + annuity.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 1.233e-02 5.160e-03 2.390 0.0187 \*  
## unemployment.l1 -5.845e-04 8.366e-04 -0.699 0.4863   
## CCI.l1 -1.493e-01 9.839e-02 -1.518 0.1323   
## CPI.l1 3.797e-02 7.773e-02 0.489 0.6263   
## KOSPI.l1 -3.925e-03 4.951e-03 -0.793 0.4298   
## annuity.l1 1.144e-01 5.930e-02 1.929 0.0565 .  
## const -9.461e-05 3.207e-04 -0.295 0.7686   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.003317 on 100 degrees of freedom  
## Multiple R-Squared: 0.1311, Adjusted R-squared: 0.07901   
## F-statistic: 2.516 on 6 and 100 DF, p-value: 0.02612   
##   
##   
## Estimation results for equation CPI:   
## ====================================   
## CPI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + annuity.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 4.594e-03 6.349e-03 0.724 0.471   
## unemployment.l1 9.576e-04 1.029e-03 0.930 0.355   
## CCI.l1 7.638e-02 1.211e-01 0.631 0.530   
## CPI.l1 -2.446e-01 9.564e-02 -2.558 0.012 \*  
## KOSPI.l1 7.108e-03 6.092e-03 1.167 0.246   
## annuity.l1 3.487e-02 7.297e-02 0.478 0.634   
## const -4.253e-05 3.947e-04 -0.108 0.914   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.004081 on 100 degrees of freedom  
## Multiple R-Squared: 0.09202, Adjusted R-squared: 0.03755   
## F-statistic: 1.689 on 6 and 100 DF, p-value: 0.1314   
##   
##   
## Estimation results for equation KOSPI:   
## ======================================   
## KOSPI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + annuity.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 0.1430615 0.0933578 1.532 0.129   
## unemployment.l1 0.0094618 0.0151360 0.625 0.533   
## CCI.l1 0.8223773 1.7801583 0.462 0.645   
## CPI.l1 -1.2334403 1.4063090 -0.877 0.383   
## KOSPI.l1 -0.5271175 0.0895782 -5.884 5.34e-08 \*\*\*  
## annuity.l1 0.7418967 1.0729801 0.691 0.491   
## const -0.0002403 0.0058031 -0.041 0.967   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.06001 on 100 degrees of freedom  
## Multiple R-Squared: 0.2751, Adjusted R-squared: 0.2316   
## F-statistic: 6.325 on 6 and 100 DF, p-value: 1.149e-05   
##   
##   
## Estimation results for equation annuity:   
## ========================================   
## annuity = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + annuity.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 5.422e-04 6.672e-03 0.081 0.9354   
## unemployment.l1 5.724e-04 1.082e-03 0.529 0.5979   
## CCI.l1 9.548e-02 1.272e-01 0.750 0.4548   
## CPI.l1 -2.061e-01 1.005e-01 -2.051 0.0429 \*   
## KOSPI.l1 5.849e-04 6.402e-03 0.091 0.9274   
## annuity.l1 -6.515e-01 7.669e-02 -8.496 1.92e-13 \*\*\*  
## const 2.071e-05 4.148e-04 0.050 0.9603   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.004289 on 100 degrees of freedom  
## Multiple R-Squared: 0.4699, Adjusted R-squared: 0.438   
## F-statistic: 14.77 on 6 and 100 DF, p-value: 5.075e-12   
##   
##   
##   
## Covariance matrix of residuals:  
## CD unemployment CCI CPI KOSPI  
## CD 3.585e-03 -2.959e-03 3.400e-06 -1.819e-05 4.696e-04  
## unemployment -2.959e-03 1.003e-01 -1.109e-04 1.810e-04 -9.113e-04  
## CCI 3.400e-06 -1.109e-04 1.100e-05 -3.414e-07 1.048e-05  
## CPI -1.819e-05 1.810e-04 -3.414e-07 1.666e-05 -6.886e-06  
## KOSPI 4.696e-04 -9.113e-04 1.048e-05 -6.886e-06 3.601e-03  
## annuity -2.677e-05 5.824e-05 -2.342e-06 -3.442e-07 2.963e-05  
## annuity  
## CD -2.677e-05  
## unemployment 5.824e-05  
## CCI -2.342e-06  
## CPI -3.442e-07  
## KOSPI 2.963e-05  
## annuity 1.839e-05  
##   
## Correlation matrix of residuals:  
## CD unemployment CCI CPI KOSPI annuity  
## CD 1.00000 -0.15600 0.01712 -0.07445 0.13069 -0.10423  
## unemployment -0.15600 1.00000 -0.10560 0.14004 -0.04794 0.04287  
## CCI 0.01712 -0.10560 1.00000 -0.02522 0.05265 -0.16464  
## CPI -0.07445 0.14004 -0.02522 1.00000 -0.02812 -0.01966  
## KOSPI 0.13069 -0.04794 0.05265 -0.02812 1.00000 0.11513  
## annuity -0.10423 0.04287 -0.16464 -0.01966 0.11513 1.00000

var\_model\_universal = VAR(insurance\_universal, p=1)  
summary(var\_model\_universal)

##   
## VAR Estimation Results:  
## =========================   
## Endogenous variables: CD, unemployment, CCI, CPI, KOSPI, universal   
## Deterministic variables: const   
## Sample size: 107   
## Log Likelihood: 1655.944   
## Roots of the characteristic polynomial:  
## 0.6766 0.5977 0.4386 0.3823 0.3823 0.1537  
## Call:  
## VAR(y = insurance\_universal, p = 1)  
##   
##   
## Estimation results for equation CD:   
## ===================================   
## CD = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + universal.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 -0.4110554 0.0929754 -4.421 2.5e-05 \*\*\*  
## unemployment.l1 -0.0009252 0.0151029 -0.061 0.951   
## CCI.l1 0.5706440 1.7137211 0.333 0.740   
## CPI.l1 -0.2445087 1.4123719 -0.173 0.863   
## KOSPI.l1 -0.0768937 0.0890395 -0.864 0.390   
## universal.l1 -1.0150751 1.3560005 -0.749 0.456   
## const 0.0004794 0.0057768 0.083 0.934   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.05974 on 100 degrees of freedom  
## Multiple R-Squared: 0.1798, Adjusted R-squared: 0.1306   
## F-statistic: 3.654 on 6 and 100 DF, p-value: 0.002542   
##   
##   
## Estimation results for equation unemployment:   
## =============================================   
## unemployment = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + universal.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 -0.942698 0.492033 -1.916 0.0582 .   
## unemployment.l1 -0.595037 0.079926 -7.445 3.48e-11 \*\*\*  
## CCI.l1 1.470733 9.069153 0.162 0.8715   
## CPI.l1 1.844055 7.474389 0.247 0.8056   
## KOSPI.l1 0.420037 0.471204 0.891 0.3748   
## universal.l1 4.624232 7.176066 0.644 0.5208   
## const 0.002094 0.030571 0.068 0.9455   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.3161 on 100 degrees of freedom  
## Multiple R-Squared: 0.3865, Adjusted R-squared: 0.3497   
## F-statistic: 10.5 on 6 and 100 DF, p-value: 5.183e-09   
##   
##   
## Estimation results for equation CCI:   
## ====================================   
## CCI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + universal.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 1.201e-02 5.214e-03 2.303 0.0234 \*  
## unemployment.l1 -5.291e-04 8.469e-04 -0.625 0.5335   
## CCI.l1 -1.871e-01 9.610e-02 -1.947 0.0543 .  
## CPI.l1 2.487e-02 7.920e-02 0.314 0.7542   
## KOSPI.l1 -3.540e-03 4.993e-03 -0.709 0.4799   
## universal.l1 9.866e-02 7.604e-02 1.298 0.1974   
## const -9.409e-05 3.239e-04 -0.290 0.7721   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.00335 on 100 degrees of freedom  
## Multiple R-Squared: 0.1137, Adjusted R-squared: 0.06054   
## F-statistic: 2.139 on 6 and 100 DF, p-value: 0.0554   
##   
##   
## Estimation results for equation CPI:   
## ====================================   
## CPI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + universal.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 4.450e-03 6.357e-03 0.700 0.4856   
## unemployment.l1 9.700e-04 1.033e-03 0.939 0.3498   
## CCI.l1 6.393e-02 1.172e-01 0.546 0.5866   
## CPI.l1 -2.478e-01 9.657e-02 -2.566 0.0118 \*  
## KOSPI.l1 7.248e-03 6.088e-03 1.191 0.2366   
## universal.l1 2.430e-02 9.272e-02 0.262 0.7938   
## const -4.233e-05 3.950e-04 -0.107 0.9149   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.004084 on 100 degrees of freedom  
## Multiple R-Squared: 0.09058, Adjusted R-squared: 0.03601   
## F-statistic: 1.66 on 6 and 100 DF, p-value: 0.1387   
##   
##   
## Estimation results for equation KOSPI:   
## ======================================   
## KOSPI = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + universal.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 0.1388164 0.0935882 1.483 0.141   
## unemployment.l1 0.0096092 0.0152025 0.632 0.529   
## CCI.l1 0.5334717 1.7250163 0.309 0.758   
## CPI.l1 -1.2807898 1.4216810 -0.901 0.370   
## KOSPI.l1 -0.5235355 0.0896264 -5.841 6.48e-08 \*\*\*  
## universal.l1 0.3671835 1.3649380 0.269 0.788   
## const -0.0002354 0.0058149 -0.040 0.968   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.06013 on 100 degrees of freedom  
## Multiple R-Squared: 0.2722, Adjusted R-squared: 0.2285   
## F-statistic: 6.232 on 6 and 100 DF, p-value: 1.379e-05   
##   
##   
## Estimation results for equation universal:   
## ==========================================   
## universal = CD.l1 + unemployment.l1 + CCI.l1 + CPI.l1 + KOSPI.l1 + universal.l1 + const   
##   
## Estimate Std. Error t value Pr(>|t|)   
## CD.l1 3.017e-03 4.983e-03 0.606 0.5462   
## unemployment.l1 1.934e-04 8.094e-04 0.239 0.8117   
## CCI.l1 5.471e-02 9.184e-02 0.596 0.5527   
## CPI.l1 -1.562e-01 7.569e-02 -2.064 0.0416 \*   
## KOSPI.l1 2.469e-03 4.772e-03 0.517 0.6060   
## universal.l1 -6.576e-01 7.267e-02 -9.049 1.2e-14 \*\*\*  
## const 7.257e-06 3.096e-04 0.023 0.9813   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
##   
## Residual standard error: 0.003201 on 100 degrees of freedom  
## Multiple R-Squared: 0.4993, Adjusted R-squared: 0.4693   
## F-statistic: 16.62 on 6 and 100 DF, p-value: 3.265e-13   
##   
##   
##   
## Covariance matrix of residuals:  
## CD unemployment CCI CPI KOSPI  
## CD 3.568e-03 -2.871e-03 4.233e-06 -1.805e-05 4.696e-04  
## unemployment -2.871e-03 9.993e-02 -1.187e-04 1.792e-04 -9.373e-04  
## CCI 4.233e-06 -1.187e-04 1.122e-05 -2.632e-07 1.243e-05  
## CPI -1.805e-05 1.792e-04 -2.632e-07 1.668e-05 -6.250e-06  
## KOSPI 4.696e-04 -9.373e-04 1.243e-05 -6.250e-06 3.615e-03  
## universal -3.045e-05 3.377e-05 -2.709e-07 1.468e-06 1.240e-05  
## universal  
## CD -3.045e-05  
## unemployment 3.377e-05  
## CCI -2.709e-07  
## CPI 1.468e-06  
## KOSPI 1.240e-05  
## universal 1.025e-05  
##   
## Correlation matrix of residuals:  
## CD unemployment CCI CPI KOSPI universal  
## CD 1.00000 -0.15203 0.02116 -0.07399 0.13075 -0.15923  
## unemployment -0.15203 1.00000 -0.11212 0.13878 -0.04931 0.03337  
## CCI 0.02116 -0.11212 1.00000 -0.01923 0.06172 -0.02526  
## CPI -0.07399 0.13878 -0.01923 1.00000 -0.02545 0.11224  
## KOSPI 0.13075 -0.04931 0.06172 -0.02545 1.00000 0.06442  
## universal -0.15923 0.03337 -0.02526 0.11224 0.06442 1.00000

n=6  
A\_mat = matrix(NA, n,n)  
  
for (i in 1:n) {  
 for (j in 1:n) {  
 if (i == j) {  
 A\_mat[i,j]=1  
 }  
 }  
}  
A\_mat[1,2]=0  
A\_mat[1,3]=0  
A\_mat[1,4]=0  
A\_mat[1,5]=0  
A\_mat[1,6]=0  
A\_mat[2,1]=0  
A\_mat[2,6]=0  
A\_mat[2,5]=0  
A\_mat[3,6]

## [1] NA

A\_mat[3,6]=0  
A\_mat[4,1]=0  
A\_mat[4,2]=0  
A\_mat[4,3]=0  
A\_mat[4,5]=0  
A\_mat[4,6]=0  
A\_mat[5,6]=0  
A\_mat

## [,1] [,2] [,3] [,4] [,5] [,6]  
## [1,] 1 0 0 0 0 0  
## [2,] 0 1 NA NA 0 0  
## [3,] NA NA 1 NA NA 0  
## [4,] 0 0 0 1 0 0  
## [5,] NA NA NA NA 1 0  
## [6,] NA NA NA NA NA 1

SVAR(var\_model\_whole, Amat = A\_mat, method = "BFGS")

## Warning in SVAR(var\_model\_whole, Amat = A\_mat, method = "BFGS"): Convergence  
## not achieved after 100 iterations. Convergence value: 1 .

##   
## SVAR Estimation Results:  
## ========================   
##   
##   
## Estimated A matrix:  
## CD unemployment CCI CPI KOSPI whole  
## CD 1.0000 0.000000 0.0000 0.00000 0.00000 0  
## unemployment 0.0000 1.000000 98.2083 8.18171 0.00000 0  
## CCI 1.3176 -0.025205 1.0000 1.43173 16.33730 0  
## CPI 0.0000 0.000000 0.0000 1.00000 0.00000 0  
## KOSPI -0.3246 2.999401 -31.1452 -2.21428 1.00000 0  
## whole 0.0958 0.003962 0.1195 0.08313 -0.01628 1

SVAR(var\_model\_annuity, Amat = A\_mat, method = "BFGS")

## Warning in SVAR(var\_model\_annuity, Amat = A\_mat, method = "BFGS"): Convergence  
## not achieved after 100 iterations. Convergence value: 1 .

##   
## SVAR Estimation Results:  
## ========================   
##   
##   
## Estimated A matrix:  
## CD unemployment CCI CPI KOSPI annuity  
## CD 1.00000 0.000000 0.0000 0.00000 0.00000 0  
## unemployment 0.00000 1.000000 98.2106 8.18427 0.00000 0  
## CCI 1.30382 0.011637 1.0000 1.42724 -16.25492 0  
## CPI 0.00000 0.000000 0.0000 1.00000 0.00000 0  
## KOSPI -0.32076 2.986316 -30.8179 -2.18843 -1.00000 0  
## annuity 0.09517 0.002409 0.1217 0.08263 0.02338 1

SVAR(var\_model\_universal, Amat = A\_mat, method = "BFGS")

## Warning in SVAR(var\_model\_universal, Amat = A\_mat, method = "BFGS"):  
## Convergence not achieved after 100 iterations. Convergence value: 1 .

##   
## SVAR Estimation Results:  
## ========================   
##   
##   
## Estimated A matrix:  
## CD unemployment CCI CPI KOSPI universal  
## CD 1.00000 0.000000 0.00000 0.00000 0.00000 0  
## unemployment 0.00000 1.000000 98.20972 8.18432 0.00000 0  
## CCI 1.30186 0.014364 1.00000 1.42485 -16.22423 0  
## CPI 0.00000 0.000000 0.00000 1.00000 0.00000 0  
## KOSPI -0.32279 2.993704 -30.48343 -2.16018 -1.00000 0  
## universal 0.09552 0.002619 0.09743 0.08101 0.01863 1