# R software code

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# Exercise 2.4

# VAR Modeling

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rm(list=ls())

library(urca)

library(vars)

macv.all<-(read.csv('Chap2Ex4.csv', header = TRUE, sep = ';', dec='.'))

macv<- macv.all[,2:8]

## 1. ADF test for GDP (original time series)

# summary(ur.df(macv[,'DR'], type='trend', lags=2))

# 1. Johansen trace test

VECM2<- ca.jo(macv[, c('DR', 'GDP', 'UR','RE','ER','EUR3M','IRS10')], type = 'trace',ecdet='none', K =2, spec ='transitory')

summary(VECM2)

# Output

# Test type: trace statistic , with linear trend

# Eigenvalues (lambda):

# [1] 0.5330528 0.4673271 0.3179333 0.2189424 0.1950975 0.1719536 0.1148249

# Values of teststatistic and critical values of test:

# test 10pct 5pct 1pct

# r <= 6 | 8.54 6.50 8.18 11.65

# r <= 5 | 21.75 15.66 17.95 23.52

# r <= 4 | 36.94 28.71 31.52 37.22

# r <= 3 | 54.24 45.23 48.28 55.43

# r <= 2 | 81.02 66.49 70.60 78.87

# r <= 1 | 125.11 85.18 90.39 104.20

# r = 0 | 178.42 118.99 124.25 136.06

# OLS regressions of an unrestricted VECM

sjd.VECM2<- cajools(VECM2, r=4)

summary(sjd.VECM2)

# Output

#lm(formula = substitute(form1), data = data.mat)

#Residuals:

# Min 1Q Median 3Q Max

#-1.2893 -0.2350 0.0296 0.2554 1.2798

#Coefficients:

# Estimate Std. Error t value Pr(>|t|)

#constant 2.239e+01 1.048e+01 2.137 0.0371 \*

#DR.dl1 -1.031e+01 2.221e+01 -0.464 0.6444

#GDP.dl1 -6.724e-05 4.917e-05 -1.367 0.1770

#UR.dl1 -5.726e+01 4.150e+01 -1.380 0.1732

#RE.dl1 7.179e-01 9.177e-02 7.822 1.7e-10 \*\*\*

#ER.dl1 4.607e-01 1.527e+00 0.302 0.7640

#EUR3M.dl1 3.497e+01 2.630e+01 1.330 0.1890

#BTP10.dl1 3.282e+01 1.372e+01 2.392 0.0202 \*

#DR.l1 -7.530e+00 1.550e+01 -0.486 0.6289

#GDP.l1 -4.035e-05 2.253e-05 -1.791 0.0788 .

#UR.l1 -4.777e+01 3.455e+01 -1.383 0.1723

#RE.l1 -2.436e-02 2.437e-02 -0.999 0.3219

#ER.l1 -1.467e+00 1.019e+00 -1.440 0.1556

#EUR3M.l1 -1.430e+01 8.938e+00 -1.600 0.1154

#IRS10.l1 -7.701e+00 5.784e+00 -1.331 0.1886

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#Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

#

#Residual standard error: 0.4866 on 55 degrees of freedom

#Multiple R-squared: 0.9262, Adjusted R-squared: 0.9061

#F-statistic: 46.02 on 15 and 55 DF, p-value: < 2.2e-16

# VEC to VAR transformation

vec2var<-vec2var(VECM2,r=4)

# 2. Test statistics

vec2var.test<- serial.test(vec2var , lags.pt=10, type="PT.asymptotic")

vec2var.test$serial

# Output

# Portmanteau Test (asymptotic)

# data: Residuals of VAR object vec2var

# Chi-squared = 440.3307, df = 399, p-value = 0.0751

vec2var.norm<- normality.test(vec2var)

vec2var.norm$jb.mul

# Output

# $JB

# JB-Test (multivariate)

# data: Residuals of VAR object vec2var

# Chi-squared = 18.3024, df = 14, p-value = 0.1934

#$ Skewness

# Skewness only (multivariate)

# data: Residuals of VAR object vec2var

# Chi-squared = 10.9739, df = 7, p-value = 0.1398

# $Kurtosis

# Kurtosis only (multivariate)

# data: Residuals of VAR object vec2var

# Chi-squared = 7.3285, df = 7, p-value = 0.3955

vec2var.arch<- arch.test(vec2var , lags.multi=5)

vec2var.arch$arch.mul

# Output

# ARCH (multivariate)

# data: Residuals of VAR object vec2var

# Chi-squared = 1820, df = 3920, p-value = 1

# 3. Impulse-response analysis

irf.DR<- irf(vec2var, impulse='GDP', response='DR', n.ahead=20, boot=TRUE)

irf.DR.cum<- irf(vec2var,impulse='GDP', response='DR',n.ahead=12,cumulative = TRUE,boot=TRUE)

plot(irf.DR.cum, names='DR')