Remember to upload the Data files and R functions file before loading the codes:

1. US_New_Data_With_EPU.xlsx
2. functions.R

```
#Installing libraries:
install.packages("openxlsx")
install.packages("stargazer")
install.packages("parallel")
install.packages("moments")
install.packages("urca")
install.packages("WeightedPortTest")
```

```
Installing package into ‘/usr/local/lib/R/site-library’
(as ‘lib’ is unspecified)

Installing package into ‘/usr/local/lib/R/site-library’
(as ‘lib’ is unspecified)

Installing package into ‘/usr/local/lib/R/site-library’
(as ‘lib’ is unspecified)

Warning message:
“package ‘parallel’ is a base package, and should not be updated”
Installing package into ‘/usr/local/lib/R/site-library’
(as ‘lib’ is unspecified)

Installing package into ‘/usr/local/lib/R/site-library’
(as ‘lib’ is unspecified)

Installing package into ‘/usr/local/lib/R/site-library’
(as ‘lib’ is unspecified)
```

Start coding or generate with AI.

```
# Libraries Loading:
library("openxlsx")
library("stargazer")
library("parallel")
library("moments")
library("urca")
library("WeightedPortTest")
```

```
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
```

```
# I created a R file functions list as described in the beginning of the notebook. The files contain functions to run analysis related t
source("functions.R")
```

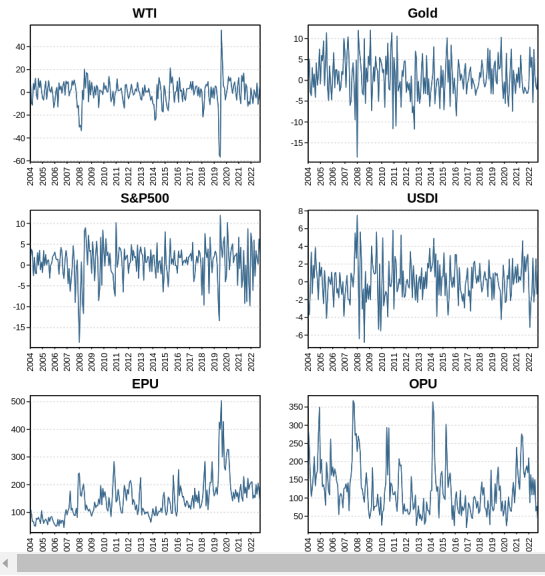
```
# Data Loading:
RAW = read.xlsx("./US_New_Data_With_EPU.xlsx", detectDates=TRUE, 1)
RAW = na.omit(RAW)
print(str(RAW))

DATA = RAW[,-1]
k = ncol(DATA)
k
print(paste("Using", k, "series, namely:"))
NAMES = colnames(DATA)
print(NAMES)
DATE = as.Date(RAW[,1], "%Y-%m-%d")
print(paste("From", DATE[1], "to", DATE[length(DATE)]))
```

```
'data.frame':   226 obs. of  7 variables:
 $ Date  : Date, format: "2004-10-01" "2004-11-01" ...
 $ WTI   : num  14.52 -9.2 -11.19 7.79 2.38 ...
 $ Gold  : num  2.43 5.09 -2.8 -3.68 3.03 ...
 $ S&P500: num  1.39 3.79 3.19 -2.56 1.87 ...
 $ USDI  : num  -2.84 -3.71 -1.19 3.34 -1.31 ...
 $ EPU   : num  118.3 96.7 66.5 66.7 51.7 ...
 $ OPU   : num  301 243 164 105 127 ...
NULL
6
[1] "Using 6 series, namely:"
[1] "WTI"    "Gold"   "S&P500" "USDI"   "EPU"    "OPU"
[1] "From 2004-10-01 to 2023-07-01"
```

```
#Transforming data into matrix:
date = DATE
Y = matrix(NA, ncol=k, nrow=nrow(DATA))
for (i in 1:k) {
  Y[,i] = (DATA[,i])
}
```

```
# Time-series Plots:
split = 2
par(mfrow=c(ceiling(k/split),split), oma=c(0.5,0.5,0,0), mar=c(1.5,1,1.5,1), mgp=c(0.5,0.5,0), mai=c(0.3,0.3,0.3,0.3))
for (i in 1:k) {
  plot(date, Y[,i], type="l", las=1, xlab="", ylab="", main=NAMES[i], col="steelblue4",
       xaxs="i", xaxt="n", cex.axis=1, cex.main=1.5, tck=-0.025)
  grid(NA, NULL)
  lines(date, Y[,i], col="steelblue4")
  axis.Date(side=1, date, at=seq(date[1], tail(date, 1), by="years"), format="%Y", las=2, tck=-0.01, cex.axis=1)
  box()
}
```




```
### Descriptive Statistics:
print("Summary Statistics")
colnames(Y) = NAMES
summary_statistics = Moments(Y)
print(summary_statistics)
```

```
[1] "Summary Statistics"
          WTI          Gold         S&P500       USDI         EPU
Mean      "0.2231"     "0.6844"     "0.6262"     "0.0679"     "144.8461"
Variance  "120.736"    "23.5148"    "19.2863"    "5.0206"     "4760.3034"
Skewness  "-0.923***"  "-0.146"     "-0.825***"  "0.102"      "1.750***"
          "(0.000)"    "(0.356)"    "(0.000)"    "(0.521)"    "(0.000)"
Kurtosis  "7.699***"   "0.575*"     "1.735***"   "0.740**"    "5.114***"
          "(0.000)"    "(0.090)"    "(0.001)"    "(0.044)"    "(0.000)"
JB        "590.309***" "3.921"      "53.988***"  "5.543*"     "361.652***"
          "(0.000)"    "(0.141)"    "(0.000)"    "(0.063)"    "(0.000)"
ERS       "-2.748***"  "-5.090***"  "-5.330***"  "-2.289**"   "-2.719***"
          "(0.006)"    "(0.000)"    "(0.000)"    "(0.023)"    "(0.007)"
Q(20)     "32.487**"   "20.075"     "34.200**"   "34.746**"   "838.535***"
          "(0.038)"    "(0.453)"    "(0.025)"    "(0.021)"    "(0.000)"
Q2(20)    "147.467***" "22.399***"  "57.970***"  "50.884***"  "405.944***"
          "(0.000)"    "(0.006)"    "(0.000)"    "(0.000)"    "(0.000)"
          OPU
Mean      "123.7088"
Variance  "4962.328"
Skewness  "1.219***"
```

```
                "(0.000)"
        Kurtosis "1.503***"
                "(0.002)"
        JB      "77.237***"
                "(0.000)"
        ERS     "-1.247"
                "(0.214)"
        Q(20)   "228.472***"
                "(0.000)"
        Q2(20)  "135.576***"
                "(0.000)"
```

```
# TVP-VAR Model parameter setting:
p = 3  # lag length
H = 10 # forecast horizon
prior = UninformativePrior(0.1, k, p)
prior
tvpvar = TVPVAR(Y, l=c(0.99, 0.99), p, prior)
B_t = tvpvar$beta_t
Q_t = tvpvar$Q_t
```

0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 ·
0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 ·
0 · 0 · 0 · 0 · 0 · 0 · 0 · 0

$Vprior

A matrix: 108 × 108 of type dbl

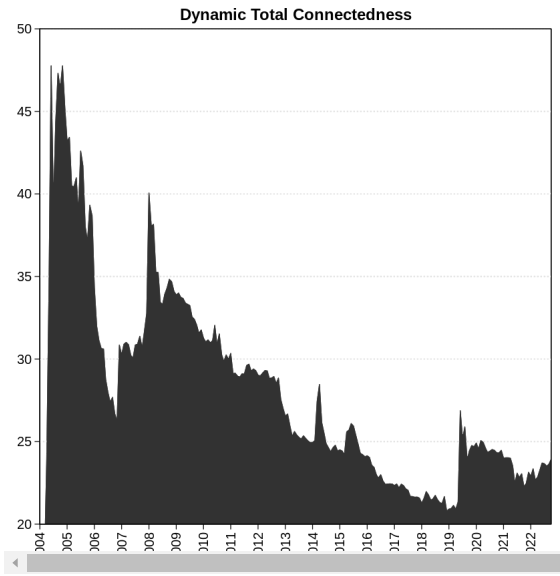
0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	⋯	0	0	0	0	0	0	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋱	⋮	⋮	⋮	⋮	⋮	⋮	
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000
0	0	0	0	0	0	0	0	0	0	⋯	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000

```
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.01111111 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.01111111 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.01111111 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.01111111 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.01111111 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.01111111 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.011111
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
0 0 0 0 0 0 0 0 0 0 ⋯ 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.000000
```

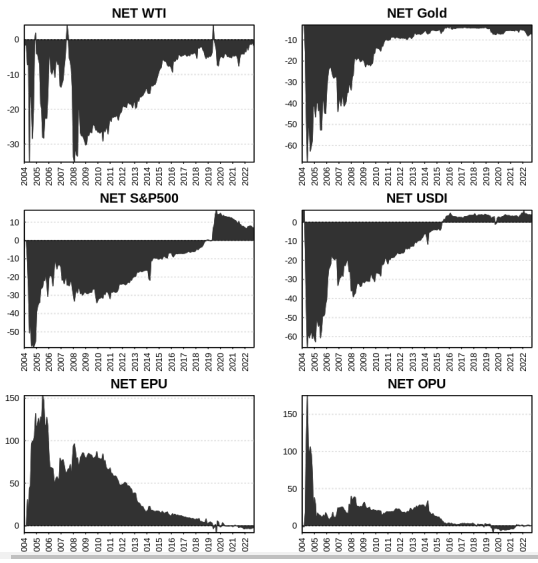
```
###Table: Averaged connectedness based on TVP-VAR-DY model
dy12 = DY12(B_t, Q_t, H, NAMES)
CT_dy12 = dy12$CT
TOTAL_dy12 = dy12$TOTAL
NET_dy12 = dy12$NET
NPSO_dy12 = dy12$NPSO
print("DY12; Averaged connectedness table")
print(dy12$TABLE)
```

```
[1] "DY12; Averaged connectedness table"
       WTI      Gold     S&P500   USDI     EPU      OPU      FROM    
WTI    "69.18"  " 1.10"  " 6.63"  " 5.33"  " 8.54"  " 9.21"  "30.82" 
Gold   " 2.14"  "69.99"  " 1.39"  "13.90"  " 7.51"  " 5.08"  "30.01" 
S&P500 " 6.71"  " 1.81"  "61.81"  "11.37"  "11.86"  " 6.44"  "38.19" 
USDI   " 5.09"  "11.46"  "11.69"  "54.49"  "11.32"  " 5.95"  "45.51" 
EPU    " 2.48"  " 0.42"  " 2.69"  " 0.49"  "91.20"  " 2.72"  " 8.80" 
OPU    " 2.26"  " 0.68"  " 2.04"  " 0.90"  " 8.68"  "85.44"  "14.56" 
TO     "18.68"  "15.46"  "24.45"  "32.00"  "47.90"  "29.40"  "167.90"
NET    "-12.14" "-14.55" "-13.74" "-13.51" " 39.10" " 14.84" "TCI"   
NPDC   " 2.00"  " 1.00"  " 1.00"  " 2.00"  " 5.00"  " 4.00"  "27.98" 
```

```
### CONNECTEDNESS PLOTS ----
# DYNAMIC TOTAL CONNECTEDNESS:
t = length(TOTAL_dy12)
par(mfcol=c(1,1), oma=c(0.5,0.5,0,0), mar=c(1.5,1,1.5,1)+0.3, mgp=c(0.5,0.5,0))
plot(date, TOTAL_dy12, type="l",xaxs="i",col="grey20", las=1, main="Dynamic Total Connectedness",ylab="",ylim=c(20,50),yaxs="i",xlab="",
grid(NA,NULL,lty=3)
polygon(c(date, rev(date)), c(rep(0, t), rev(TOTAL_dy12)), col="grey20", border="grey20")
axis.Date(side=1, date, at=seq(date[1], tail(date, 1), by="years"), format="%Y", las=2, tck=-0.01, cex.axis=1)
box()
```



```
# NET TOTAL DIRECTIONAL CONNECTEDNESS:
par(mfrow=c(ceiling(k/split),split), oma=c(0.5,0.5,0,0), mar=c(1.5,1,1.5,1), mgp=c(0.5,0.5,0), mai=c(0.3,0.3,0.3,0.3))
for (i in 1:k){
  plot(date, NET_dy12[,i], xlab="", ylab="", type="l", xaxs="i", col="grey20", las=1, main=paste("NET",NAMES[i]),tck=0.01,yaxs="i",xaxt=
  grid(NA, NULL, lty=3)
  polygon(c(date, rev(date)), c(rep(0, t), rev(NET_dy12[,i])), col="grey20", border="grey20")
  abline(h=0, lty=3)
  axis.Date(side=1, date, at=seq(date[1], tail(date, 1), by="years"), format="%Y", las=2, tck=-0.01, cex.axis=1)
  box()
}
```




```
p = 3  # lag length
H = 10 # forecast horizon
prior = UninformativePrior(0.1, k, p)
tvpvar = TVPVAR(Y, l=c(0.99, 0.99), p, prior)
B_t = tvpvar$beta_t
Q_t = tvpvar$Q_t

dy12 = DY12(B_t, Q_t, H, NAMES)
ct_dy12 = dy12$CT
npso_dy12 = -dy12$NPSO
lw20 = LW20(B_t, Q_t, H, NAMES)
ct_lw20 = lw20$CT
npso_lw20 = lw20$NPSO
```

```
[1] 54
[1] 55
[1] 56
[1] 57
[1] 58
[1] 59
[1] 60
[1] 61
[1] 62
[1] 63
[1] 64
[1] 65
[1] 66
[1] 67
[1] 68
[1] 69
[1] 70
[1] 71
[1] 72
[1] 73
[1] 74
[1] 75
[1] 76
[1] 77
[1] 78
[1] 79
[1] 80
[1] 81
[1] 82
[1] 83
```