'LW.prg

'A. Create the workfile

wfcreate u 1 500000

'B. read in the data

import "C:\Users\timr\Dropbox\Neutral real rate\2023\Code summary\LW\LWdata.csv" ftype=ascii rectype=crlf skip=0 fieldtype=delimited delim=comma colhead=0 eoltype=pad badfield=NA @freq U @id @date @destid @date @smpl @all

rename series01 z1

rename series02 z2

'C. Declare the state space model

sspace smodel

' SSF: ------------------------------------------------------------------------------------

' Z(t) = D1\*X(t) + D2\*X(t-1) + R\*u(t)

' X(t) = A\*X(t-1) + C\*u(t), u(t) ~ MN(0,I)

' -----------------------------------------------------------------------------------------

'We use

' SSF: ------------------------------------------------------------------------------------

' Z(t) = D1\*X(t) + D2\*X1(t) + R\*u(t)

' X(t) = A\*X(t-1) + C\*u(t), u(t) ~ MN(0,I)

' X1(t) = X(t-1)

' -----------------------------------------------------------------------------------------

'Measurement equations

'D1

'LW

'1 2 3 4 5 6 7 8 9 10 11

'1 -1.51000000000000 0 0 0.0490000000000000 0.387000000000000 0 0 0 0 0

'0 0.0430000000000000 0 0 0 0 0.731000000000000 0 0 0 0

'HLW

'1 -1.53990000000000 0 0 0.0339500000000000 0.333800000000000 0 0 0 0 0

'0 0.0756000000000000 0 0 0 0 0.786200000000000 0 0 0 0

'Post Covid

'1 -1.38720000000000 0 0 0.0395000000000000 0.451600000000000 0 0 0 0 0

'0 0.0733000000000000 0 0 0 0 0.787300000000000 0 0 0 0

'D2

'1 2 2 4 5 6 7 8 9 10 11

'LW

'0 0.570000000000000 0 0 0.0490000000000000 0 0 0 0 0 0

'0 0 0 0 0 0 0 0 0 0 0

'HLW

'0 0.598600000000000 0 0 0.0339500000000000 0 0 0 0 0 0

'0 0 0 0 0 0 0 0 0 0 0

'Post Covid

'0 0.450700000000000 0 0 0.0395000000000000 0 0 0 0 0 0

'0 0 0 0 0 0 0 0 0 0 0

'R

'0 0 0 0 0

'0 0 0 0 0

smodel.append @signal z1 = x1 -1.51000000000000\*x2 +0.0490000000000000\*x5 + 0.387000000000000\*x6 + 0.570000000000000\*x1\_2 + 0.0490000000000000\*x1\_5

smodel.append @signal z2 = 0.0430000000000000\*x2 + 0.731000000000000\*x7

'State equations

'A

'1 2 3 4 5 6 7 8 9 10 11

'1 0 1 0 0 0 0 0 0 0 0

'1 0 0 0 0 0 0 0 0 0 0

'0 0 1 0 0 0 0 0 0 0 0

'0 0 0 1 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

'HLW

'1 0 1 0 0 0 0 0 0 0 0

'1 0 0 0 0 0 0 0 0 0 0

'0 0 1 0 0 0 0 0 0 0 0

'0 0 0 1 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

'Post COVID

'1 0 1 0 0 0 0 0 0 0 0

'1 0 0 0 0 0 0 0 0 0 0

'0 0 1 0 0 0 0 0 0 0 0

'0 0 0 1 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

'C

'1 2 3 4 5

'LW

'0 0 0 0.605000000000000 0

'0 0 0 0 0

'0 0 0 0 0.102000000000000

'0 0 0.323000000000000 0 0.108936000000000

'0 0 0 0 0

'1 0 0 0 0

'0 1 0 0 0

'0 0 1 0 0

'0 0 0 1 0

'0 0 0 0 1

'0 0 0.323000000000000 0 0.108936000000000

'HLW

'0 0 0.573900000000000 0 0

'0 0 0 0 0

'0 0 0 0.123000000000000 0

'0 0 0 0.123000000000000 0.174200000000000

'0 0 0 0 0

'1 0 0 0 0

'0 1 0 0 0

'0 0 1 0 0

'0 0 0 1 0

'0 0 0 0 1

'0 0 0 0.123000000000000 0.174200000000000

'Post COVID

'0 0 0.500000000000000 0 0

'0 0 0 0 0

'0 0 0 0.145300000000000 0

'0 0 0 0.163941990000000 0.118100000000000

'0 0 0 0 0

'1 0 0 0 0

'0 1 0 0 0

'0 0 1 0 0

'0 0 0 1 0

'0 0 0 0 1

'0 0 0 0.163941990000000 0.118100000000000

'Declare the error terms

smodel.append @ename e1

smodel.append @ename e2

smodel.append @ename e3

smodel.append @ename e4

smodel.append @ename e5

smodel.append @evar var(e1) = 1

smodel.append @evar var(e2) = 1

smodel.append @evar var(e3) = 1

smodel.append @evar var(e4) = 1

smodel.append @evar var(e5) = 1

'State equations

smodel.append @state x1 = x1(-1) + x3(-1) + 0.605000000000000\*e3

smodel.append @state x2 = x1(-1)

smodel.append @state x3 = x3(-1) + 0.102000000000000\*e5

smodel.append @state x4 = x4(-1) + 0.323000000000000\*e3 + 0.108936000000000\*e5

smodel.append @state x5 = x4(-1)

smodel.append @state x6 = e1

smodel.append @state x7 = e2

smodel.append @state x8 = e3

smodel.append @state x9 = e4

smodel.append @state x10 = e5

smodel.append @state x11 = 0.323000000000000\*e3 + 0.108936000000000\*e5

'Lags

smodel.append @state x1\_1 = x1(-1)

smodel.append @state x1\_2 = x2(-1)

smodel.append @state x1\_3 = x3(-1)

smodel.append @state x1\_4 = x4(-1)

smodel.append @state x1\_5 = x5(-1)

smodel.append @state x1\_6 = x6(-1)

smodel.append @state x1\_7 = x7(-1)

smodel.append @state x1\_8 = x8(-1)

smodel.append @state x1\_9 = x9(-1)

smodel.append @state x1\_10 = x10(-1)

smodel.append @state x1\_11 = x11(-1)

'D. Generate the smoothed states

smpl 3 @last

'Estimate the model

smodel.ml

smodel.makestates(t=smooth) \*f

scalar stdevdr =@stdev(x11f)

'E. Save the results

wfsave lw\_out