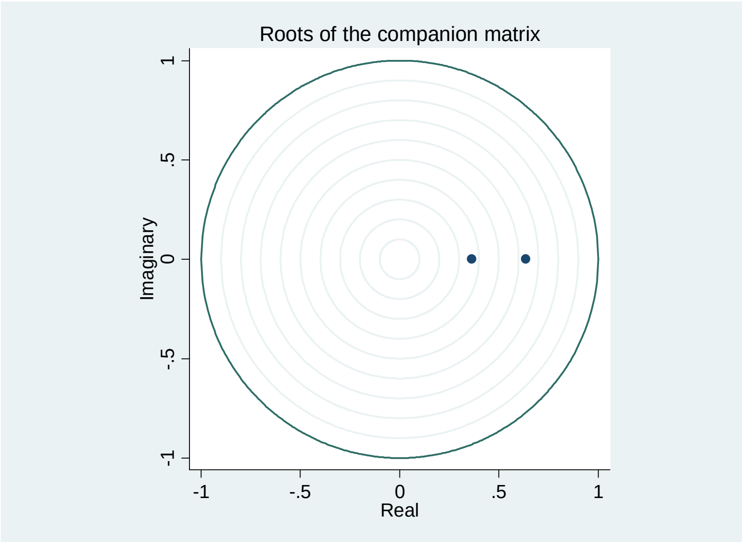
Vector Autoregressive (VARs) Models

Do file command in generating VARs system:

```
set obs 500
g t=_n
tsset t
matrix c=(1, 0.7\ 0.7, 1)
corr2data u1 u2, n(500) mean(0 0) sds(4 5) corr(c)
g x=0.1 in 1
g y=0.1 in 1
forvalues i = 2(1)500 {
replace x=0.1+0.4*l.x+0.1*l.y+u1 in `i'
replace y=0.1+0.2*l.x+0.5*l.y+u2 in `i'
}
```

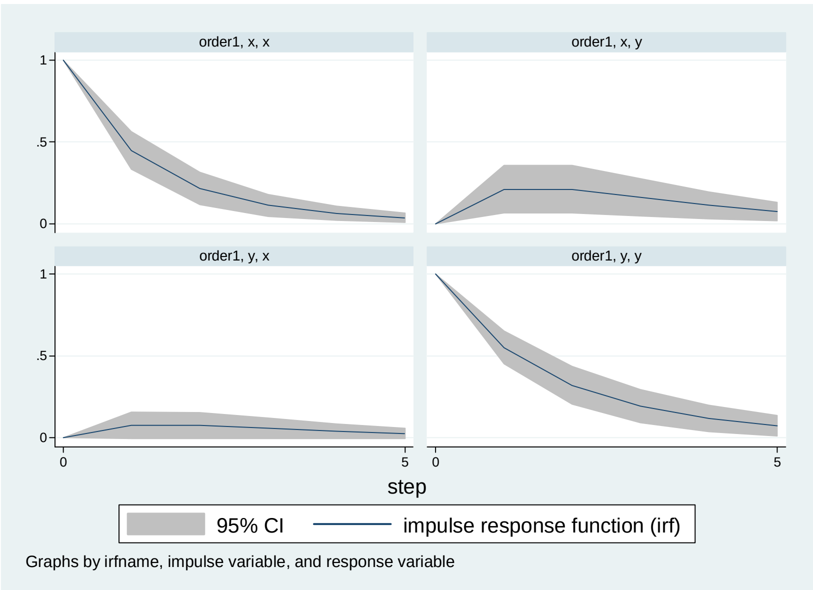
```
. varsoc x y, maxlag(5)

   Selection-order criteria
   Sample:  6 - 500                             Number of obs      =       495
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 |  -2893.9                        413.574   11.7006   11.7073   11.7176  |
  |  1 | -2714.46  358.88*   4  0.000  203.566*  10.9917*  11.0117*  11.0427* |
  |  2 |  -2713.1  2.7025    4  0.609  205.756   11.0024   11.0358   11.0874  |
  |  3 | -2709.93  6.3522    4  0.174  206.443   11.0058   11.0525   11.1247  |
  |  4 | -2707.94  3.9694    4  0.410  208.131   11.0139   11.0739   11.1668  |
  |  5 | -2706.44  2.9994    4  0.558  210.246    11.024   11.0974   11.2109  |
  +---------------------------------------------------------------------------+
   Endogenous:  x y
    Exogenous:  _cons

. var x y, lag(1/1)

Vector autoregression

Sample:  2 - 500                                   No. of obs      =       499
Log likelihood =  -2737.92                         AIC             =  10.99768
FPE            =  204.7773                         HQIC            =  11.01755
Det(Sigma_ml)  =  199.9115                         SBIC            =  11.04833

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
x                     3     3.99669   0.2843   198.2512   0.0000
y                     3     4.99515   0.4501   408.4947   0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
x            |
           x |
         L1. |   .4468057   .0588941     7.59   0.000     .3313754     .562236
           y |
         L1. |   .0754163   .0413395     1.82   0.068    -.0056076    .1564402
       _cons |   .1106178   .1785841     0.62   0.536    -.2394007    .4606362
-------------+----------------------------------------------------------------
y            |
           x |
         L1. |   .2107341   .0736072     2.86   0.004     .0664666    .3550015
           y |
         L1. |   .5518876    .051667    10.68   0.000      .450622    .6531531
       _cons |   .0930667   .2231985     0.42   0.677    -.3443944    .5305278
------------------------------------------------------------------------------

. varstable, graph
   Eigenvalue stability condition
  +----------------------------------------+
  |        Eigenvalue         |   Modulus  |
  |---------------------------+------------|
  |   .6359239                |   .635924  |
  |   .3627695                |   .362769  |
  +----------------------------------------+
```

```
   All the eigenvalues lie inside the unit circle.
   VAR satisfies stability condition.
```



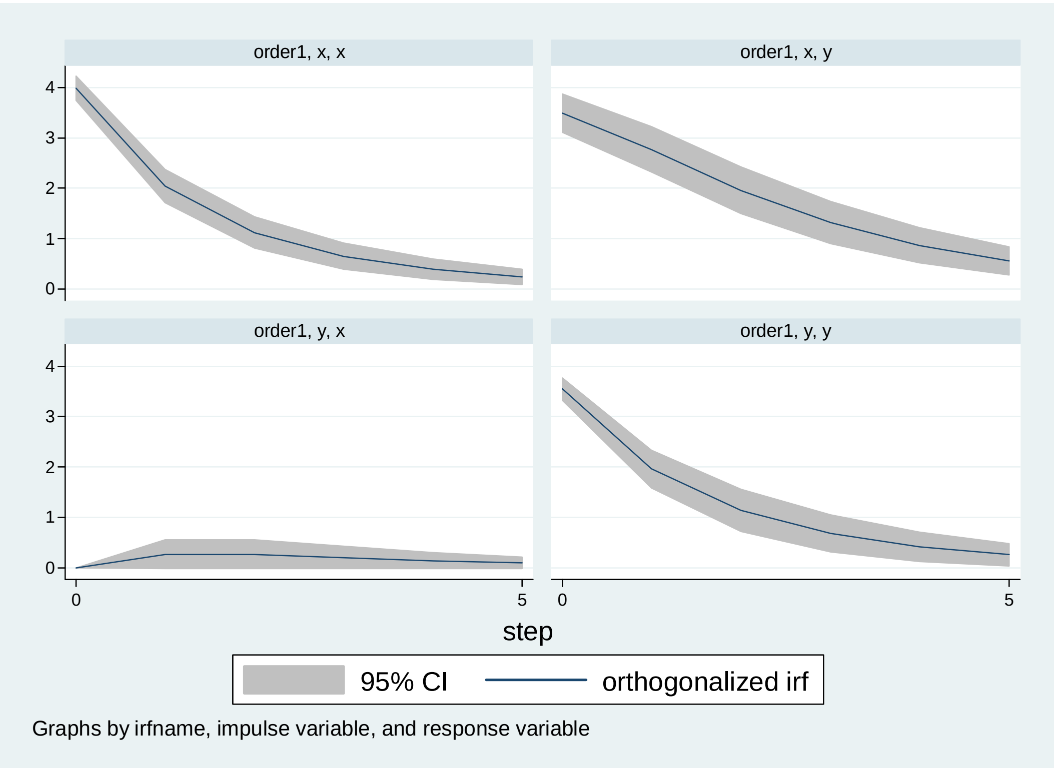

```
. vargranger

   Granger causality Wald tests
  +------------------------------------------------------------------+
  |          Equation           Excluded |   chi2     df Prob > chi2 |
  |--------------------------------------+---------------------------|
  |                 x                  y |  3.3281     1    0.068    |
  |                 x                ALL |  3.3281     1    0.068    |
  |--------------------------------------+---------------------------|
  |                 y                  x |  8.1965     1    0.004    |
  |                 y                ALL |  8.1965     1    0.004    |
  +------------------------------------------------------------------+

. matrix A=(0.44680573, 0.07541627\0.21073409, 0.5518876)

. matrix list A

A[2,2]
           c1         c2
r1  .44680573  .07541627
r2  .21073409   .5518876

. matrix IRF0=(1\0)

. matrix list IRF0

IRF0[2,1]
    c1
r1   1
r2   0

. matrix IRF1=A*IRF0

. matrix list IRF1

IRF1[2,1]
           c1
r1  .44680573
r2  .21073409

. matrix IRF2=A*IRF1

. matrix list IRF2

IRF2[2,1]
           c1
r1  .21552814
r2  .21045873
```

```
. matrix IRF=(IRF0'\IRF1'\IRF2')

. matrix rownames IRF = IRF0 IRF1 IRF2

. matrix colnames IRF = x y

. matrix list IRF

IRF[3,2]
               x           y
IRF0           1           0
IRF1   .44680573   .21073409
IRF2   .21552814   .21045873

. irf create order1, o(x y) step(5) set(irf01)
(file irf01.irf now active)

. irf table irf, impulse(x y) response(x y)

                         Results from order1
+--------------------------------------------------------------------------------+
|         |    (1)         (1)         (1)      |    (2)         (2)         (2)      |
|  step   |    irf        Lower       Upper     |    irf        Lower       Upper     |
|---------+------------------------------------+------------------------------------|
|0        | 1           1           1           | 0           0           0           |
|1        | .446806     .331375     .562236     | .210734     .066467     .355002     |
|2        | .215528     .116894     .314162     | .210459     .063969     .356948     |
|3        | .112171     .045171     .179171     | .161569     .046549     .276588     |
|4        | .062304     .018995     .105612     | .112806     .030239     .195373     |
|5        | .036345     .008215     .064475     | .075386     .018213     .132558     |
+--------------------------------------------------------------------------------+
+--------------------------------------------------------------------------------+
|         |    (3)         (3)         (3)      |    (4)         (4)         (4)      |
|  step   |    irf        Lower       Upper     |    irf        Lower       Upper     |
|---------+------------------------------------+------------------------------------|
|0        | 0           0           0           | 1           1           1           |
|1        | .075416     -.005608    .15644      | .551888     .450622     .653153     |
|2        | .075318     -.004677    .155312     | .320473     .204196     .436749     |
|3        | .057821     -.004913    .120556     | .192737     .090064     .29541      |
|4        | .04037      -.00552     .086261     | .118554     .036596     .200512     |
|5        | .026979     -.005686    .059644     | .073936     .011842     .136029     |
+--------------------------------------------------------------------------------+
95% lower and upper bounds reported
(1) irfname = order1, impulse = x, and response = x
(2) irfname = order1, impulse = x, and response = y
(3) irfname = order1, impulse = y, and response = x
(4) irfname = order1, impulse = y, and response = y

. irf graph irf, impulse(x y) response(x y)
```

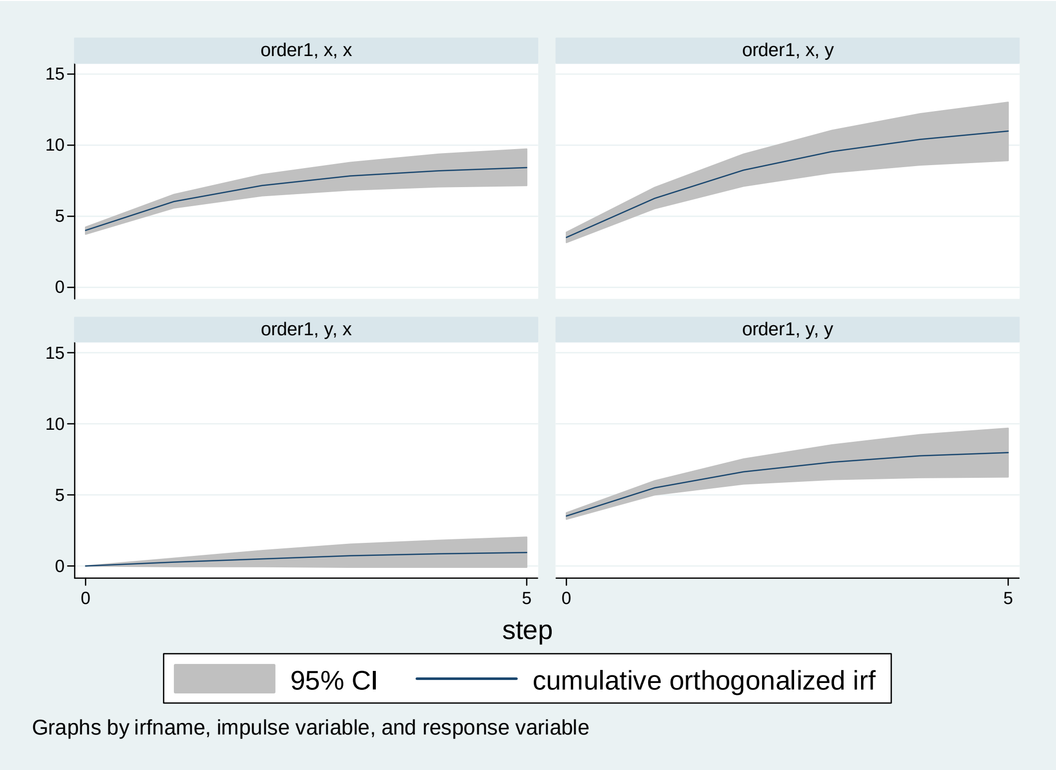


```
. predict u1hat, eq(#1) r
(1 missing value generated)

. predict u2hat, eq(#2) r
(1 missing value generated)

. g n=499

. corr u1hat u2hat [fw=n], c
(n=249001)

             |    u1hat    u2hat
-------------+------------------
       u1hat |  15.8775
       u2hat |  13.9239  24.8016


. matrix V=r(C)

. matrix list V

symmetric V[2,2]
           u1hat      u2hat
u1hat   15.87754
u2hat   13.92393  24.801633

. matrix P=cholesky(V)

. matrix list P

P[2,2]
           u1hat      u2hat
u1hat  3.9846631          0
u2hat  3.4943808  3.5483708

. matrix U=(1\0)

. matrix OIRF0=P*U

. matrix list OIRF0

OIRF0[2,1]
              c1
u1hat  3.9846631
u2hat  3.4943808

. matrix OIRF1=A*OIRF0

. matrix list OIRF1

OIRF1[2,1]
           c1
r1  2.0439035
r2  2.7682098

. matrix OIRF2=A*OIRF1

. matrix list OIRF2

OIRF2[2,1]
           c1
r1  1.1219958
r2  1.9584608

. matrix OIRF=(OIRF0'\OIRF1'\OIRF2')

. matrix rownames OIRF=OIRF0 OIRF1 OIRF2

. matrix colnames OIRF=x y
```

```
. matrix list OIRF

OIRF[3,2]
               x          y
OIRF0  3.9846631  3.4943808
OIRF1  2.0439035  2.7682098
OIRF2  1.1219958  1.9584608

. irf table oirf, impulse(x y) response(x y)

                                         Results from order1

+--------------------------------------------------------------------------------+
|        |    (1)          (1)          (1)      |    (2)          (2)          (2)     |
|  step  |   oirf        Lower        Upper      |   oirf        Lower        Upper    |
|--------+---------------------------------------+--------------------------------------|
|0       | 3.98466      3.73744      4.23187     | 3.49437      3.11499      3.87375  |
|1       | 2.0439       1.71379      2.374       | 2.7682       2.31736      3.21904  |
|2       | 1.12199      .808855      1.43513     | 1.95846      1.49121      2.4257   |
|3       | .649013      .391032      .906993     | 1.31729      .898917      1.73566  |
|4       | .389328      .185958      .592698     | .863765      .513575      1.21396  |
|5       | .239096      .083301      .394891     | .558746      .277924      .839568  |
+--------------------------------------------------------------------------------+

+--------------------------------------------------------------------------------+
|        |    (3)          (3)          (3)      |    (4)          (4)          (4)     |
|  step  |   oirf        Lower        Upper      |   oirf        Lower        Upper    |
|--------+---------------------------------------+--------------------------------------|
|0       | 0            0            0           | 3.54836      3.32822      3.76851  |
|1       | .267604      -.020377     .555586     | 1.9583       1.57899      2.33761  |
|2       | .267255      -.01708      .551589     | 1.13715      .718574      1.55573  |
|3       | .205171      -.017798     .428139     | .683901      .317118      1.05068  |
|4       | .143249      -.019829     .306326     | .420673      .128686      .71266   |
|5       | .09573       -.02033      .21179      | .262351      .041421      .483282  |
+--------------------------------------------------------------------------------+
95% lower and upper bounds reported
(1) irfname = order1, impulse = x, and response = x
(2) irfname = order1, impulse = x, and response = y
(3) irfname = order1, impulse = y, and response = x
(4) irfname = order1, impulse = y, and response = y

. irf graph oirf, impulse(x y) response(x y)
```



```
. irf graph coirf, impulse(x y) response(x y)
```




```
. scalar Pc11=el(P,1,1)

. scalar Pc12=el(P,1,2)

. scalar Vc11=el(V,1,1)

. scalar vdx0=(Pc11^2)/(Vc11)

. scalar vdy0=(Pc12^2)/(Vc11)

. scalar list vdx0 vdy0
      vdx0 =          1
      vdy0 =          0

. matrix A1P=A*P

. matrix list A1P

A1P[2,2]
        u1hat      u2hat
r1  2.0439035  .26760489
r2  2.7682098  1.9583019

. matrix A1PT=A1P*A1P'

. matrix list A1PT

symmetric A1PT[2,2]
           r1         r2
r1  4.2491538
r2  6.1820048  11.497932

. scalar A1Pc11=el(A1P,1,1)

. scalar A1Pc12=el(A1P,1,2)

. scalar A1PTc11=el(A1PT,1,1)

. scalar vdx1=(A1Pc11^2+Pc11^2)/(A1PTc11+Vc11)
```

```
. scalar vdy1=(A1Pc12^2+Pc12^2)/(A1PTc11+Vc11)

. scalar list vdx1 vdy1
      vdx1 =  .99644192
      vdy1 =  .00355808

. matrix A2P=A*A*P

. matrix list A2P

A2P[2,2]
        u1hat      u2hat
r1  1.1219958  .26725522
r2  1.9584608   1.137156

. matrix A2PT=A2P*A2P'

. matrix list A2PT

symmetric A2PT[2,2]
           r1         r2
r1     1.3303
r2  2.5012957  5.1286924

. scalar A2Pc11=el(A2P,1,1)

. scalar A2Pc12=el(A2P,1,2)

. scalar A2PTc11=el(A2PT,1,1)

. scalar vdx2=(A2Pc11^2+A1Pc11^2+Pc11^2)/(A2PTc11+A1PTc11+Vc11)

. scalar vdy2=(A2Pc12^2+A1Pc12^2+Pc12^2)/(A2PTc11+A1PTc11+Vc11)

. scalar list vdx2 vdy2
      vdx2 =  .99333375
      vdy2 =  .00666625

. matrix FEVD=(vdx0, vdy0 \ vdx1, vdy1 \ vdx2, vdy2)

. matrix rownames FEVD = t1 t2 t3

. matrix colnames FEVD = x y

. matrix list FEVD

FEVD[3,2]
            x          y
t1          1          0
t2  .99644192  .00355808
t3  .99333375  .00666625


. irf table fevd, impulse(x y) response(x)

                              Results from order1

+--------------------------------------------------------------------------------+
|         |    (1)         (1)         (1)     |    (2)         (2)         (2)     |
|  step   |   fevd        Lower       Upper    |   fevd        Lower       Upper    |
|---------+------------------------------------+------------------------------------|
|0        | 0           0           0          | 0           0           0          |
|1        | 1           1           1          | 0           0           0          |
|2        | .996442     .988746     1.00414    | .003558     -.004138    .011254    |
|3        | .993334     .979082     1.00759    | .006666     -.007585    .020918    |
|4        | .991554     .973544     1.00956    | .008446     -.009564    .026456    |
|5        | .990691     .970807     1.01058    | .009309     -.010576    .029193    |
+--------------------------------------------------------------------------------+
95% lower and upper bounds reported
(1) irfname = order1, impulse = x, and response = x
(2) irfname = order1, impulse = y, and response = x

. irf table fevd, impulse(x y) response(y)

                              Results from order1
```

step	(1) fevd	(1) Lower	(1) Upper	(2) fevd	(2) Lower	(2) Upper
0	0	0	0	0	0	0
1	.492334	.429826	.554842	.507666	.445158	.570174
2	.547491	.47821	.616772	.452509	.383228	.52179
3	.572297	.494741	.649852	.427703	.350148	.505259
4	.583172	.501398	.664946	.416828	.335054	.498602
5	.587836	.504177	.671494	.412164	.328506	.495823

95% lower and upper bounds reported
(1) irfname = order1, impulse = x, and response = y
(2) irfname = order1, impulse = y, and response = y