Estimate Simple Reduced-Form VAR

estimate_simple_VAR.m

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Summary

Estimate an unconstrained reduced-form VAR using the data prepared in `read_data`. Look inside the VAR object at the estimated coefficient matrices and eigenvalues. Resimulate then the historical data using the estimated residuals.

Contents

1 Clear Workspace

```
11 clear;
12 close all;
13 clc;
14 %#ok<*NOPTS>
```

2 Read Data

Load historical data prepared in `read_data`, and the dates defining the start and end of the historical sample.

```
21 load read_data.mat g2 startHist endHist;
22
23 g2
24 startHist
25 endHist
```

```
g2 =
    pp: [87x1 tseries]
    yy: [87x1 tseries]
    mm: [87x1 tseries]
     r: [87x1 tseries]
startHist =
   7.9610e+03
endHist =
   8.0470e+03
```

3 Estimate Reduced-Form VAR

Estimate a second-order reduced-form VAR on the historical data. First, create an empty VAR object with variable names corresponding to those in the database, `r`, `pp`, `yy`, `mm` [1]. Then, run the function `estimate` to estimate the coefficient matrices in the following model

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \epsilon_t$$
$$\mathrm{E}\epsilon_t \epsilon_t' = \Omega$$

Note that the constant is omitted from the VAR model by setting `'const=' false'`. Request the covariance matrix of parameters by setting `|'covParameters=' true` [2] (this covariance matrix, unlike the covariance matrix of residuals, is not calculated by default).

The function `estimate` also returns a VAR database [3], with the observations on endogenous variables clipped down to the estimation range (including pre-sample initical conditions) and the

estimated residuals (forecast errors). The residuals are named `res_XX` where `XX` is the name of the corresponding variable.

```
48 v = VAR({'r','pp','yy','mm'}); [1]
49 v
50
51 p = 2;
52 [v,vd] = estimate(v,g2,startHist:endHist, ...
53     'order=',p,'const=',false, ...
54     'covParameters=',true); [2]
55
56 v
57 vd [3]
```

```
v =
        empty VAR object
        variable names: 'r' 'pp' 'yy' 'mm'
        instruments: empty
        comment: ''
        user data: empty

v =
        VAR(2) object: [1] parameterisation(s)
        variable names: 'r' 'pp' 'yy' 'mm'
        instruments: empty
        comment: ''
        user data: empty

vd =
         r: [87x1 tseries]
        pp: [87x1 tseries]
        yy: [87x1 tseries]
        mm: [87x1 tseries]
     res_r: [85x1 tseries]
    res_pp: [85x1 tseries]
    res_yy: [85x1 tseries]
    res_mm: [85x1 tseries]
```

4 Look Inside VAR Object

Use various functions, such as `get`, `mean`, or `eig`, to retrieve various pieces of information on the estimated VAR object.

Get the names of variables and residuals [4].

```
66 yNames = get(v,'yNames'); 4
67 eNames = get(v,'eNames');
68
69 disp('Names of variables');
70 yNames
71
72 disp('Names of residuals');
73 eNames
```

```
Names of variables
yNames =
    'r'    'pp'    'yy'    'mm'
Names of residuals
eNames =
    'res_r'    'res_pp'    'res_yy'    'res_mm'
```

Get the estimated coefficients in the transition matrix (which is a lag polynomial) ? and the constant vector 5.

```
80 A = get(v,'A*'); %?A%?
81 K = get(v,'K'); 5
82 Omg = get(v,'Omega');
83
84 disp('Transition matrices');
85 disp('A(1)')
86 A(:,:,1)
87 disp('A(p)');
88 A(:,:,p)
89
90 disp('Constant vector');
91 K
92
93 disp('Cov matrix of reduced-form residuals');
94 Omg
```

```
Transition matrices
A(1)
ans =
    1.5382   -0.0583    0.0310   -0.0028
    0.2041    0.2333    0.0381    0.0012
   -0.4046   -0.8197    0.2376   -0.0543
   -3.9568    2.1695   -0.1406    0.2290
A(p)
ans =
   -0.6314    0.0965   -0.0126    0.0004
```

```
   -0.0262    0.2896    0.0215    0.0235
    0.6397   -0.9185    0.1502    0.1049
    2.2617   -0.6669   -0.1176    0.0344
Constant vector
K =
     0
     0
     0
     0
Cov matrix of reduced-form residuals
Omg =
    0.0940   -0.0163    0.1875   -0.3793
   -0.0163    0.2045   -0.1455    0.1963
    0.1875   -0.1455    4.0424   -1.8227
   -0.3793    0.1963   -1.8227   22.5898
```

Get the cov matrix of parameter estimates. The matrix `Sgm` is organized as follows:

$$\Sigma = \text{cov}(\beta),$$

where the beta vector is

$$\beta = \text{vec}([K, A_1, \ldots A_p]).$$

This covariance matrix is calculated and stored in the VAR object only if you use the option `'covParameters=' true` when estimating the VAR, see the section above 2.

```
111 Sgm = get(v,'covParameters');
112
113 disp('Size of cov matrix of parameter estimates');
114 size(Sgm)
```

```
Size of cov matrix of parameter estimates
ans =
    32    32
```

Get the asymptotic mean for the endogenous variables implied by the estimated VAR.

```
121 mu = mean(v);
122
123 disp('VAR mean'); 6
124 mu
```

```
VAR mean
mu =
     0
     0
     0
     0
```

Get the eigenvalues implied by the estimated transition matrix. The number of eigenvalues is always Ny-by-P, where Ny is the number of variables and P is the order of the VAR. Display the eigenvalue with the largest magnitude; this eigenvalue determines the upper bound on the persistence of the VAR responses.

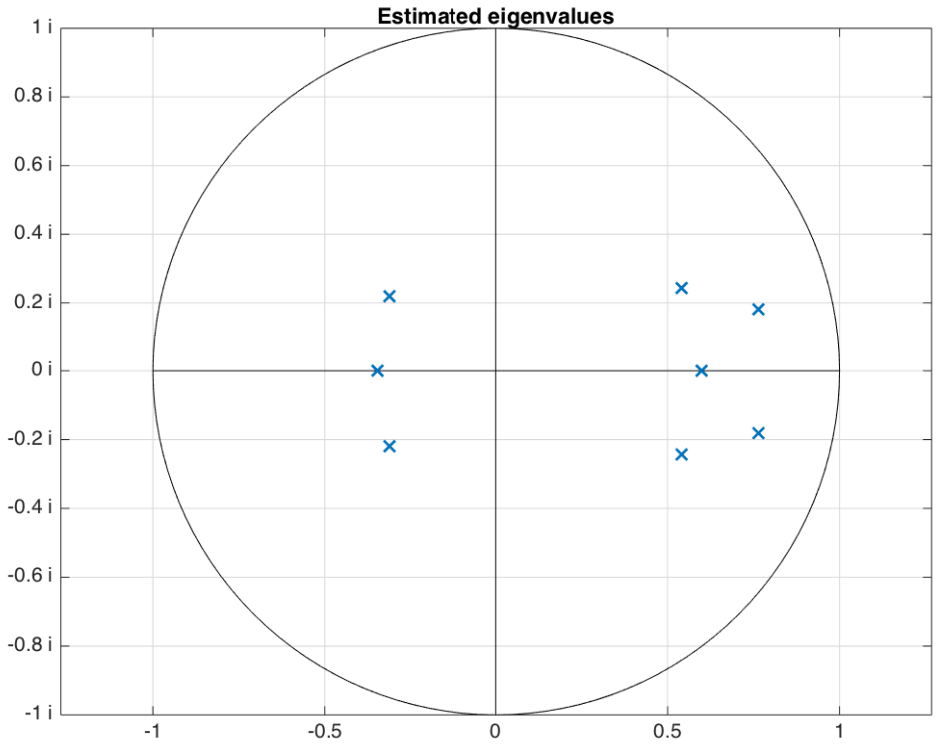
```
134 e = eig(v);
135
136 size(e)
137
138 disp('Eigenvalues');
139 e.'
140
141 disp('Magnitude of the largest root');
142 absEig = abs(e);
143 max(absEig)
```

```
ans =
     1     8
Eigenvalues
ans =
  -0.3119 + 0.2194i
  -0.3119 - 0.2194i
  -0.3467 + 0.0000i
   0.5407 + 0.2433i
   0.5407 - 0.2433i
   0.7642 + 0.1813i
   0.7642 - 0.1813i
   0.5989 + 0.0000i
Magnitude of the largest root
ans =
    0.7854
```

Plot the eigenvalues in a unit circle. The position of eigenvalues gives a good idea about the dynamics of the VAR in response to shocks and initial conditions.

```
151 figure();
152 grfun.ploteig(v);
153 grid('on');
```

```
154 title('Estimated eigenvalues');
```



5 Save Estimated VAR and Data for Further Use

```
158 save estimate_simple_VAR.mat v vd;
```

6 Help on IRIS Functions Used in This File

Use either `help` to display help in the command window, or `idoc` to display help in an HTML browser window.

```
help VAR
help VAR/estimate
help VAR/get
help VAR/mean
help VAR/eig
help grfun/ploteig
```