

```

. gen time=_n

. tsset time
    time variable:  time, 1 to 81
      delta: 1 unit

. gen lgdp=log(gdp)

. gen lm=log(m/(def/100))

. varsoc d.lgdp, exo(l.lgdp) maxlag(4)

```

-----> ラグ次数の決定

Selection-order criteria

Sample: 6 - 81

Number of obs = 76

| lag | LL | LR | df | p | FPE | AIC | HQIC | SBIC |
|-----|---------|---------|----|-------|---------|-----------|-----------|-----------|
| 0 | 238.441 | | | | .000116 | -6.22212 | -6.19761 | -6.16079 |
| 1 | 241.56 | 6.2379* | 1 | 0.013 | .00011* | -6.27788* | -6.24112* | -6.18588* |
| 2 | 241.84 | .56052 | 1 | 0.454 | .000112 | -6.25894 | -6.20992 | -6.13627 |
| 3 | 241.843 | .00611 | 1 | 0.938 | .000115 | -6.23271 | -6.17143 | -6.07937 |
| 4 | 242.838 | 1.9899 | 1 | 0.158 | .000115 | -6.23258 | -6.15904 | -6.04857 |

Endogenous: D.lgdp

Exogenous: L.lgdp _cons

. varsoc d.lm, exo(l.lm) maxlag(4)

-----> ラグ次数の決定

Selection-order criteria

Sample: 6 - 81

Number of obs

=

76

| lag | LL | LR | df | p | FPE | AIC | HQIC | SBIC |
|-----|---------|---------|----|-------|----------|----------|-----------|----------|
| 0 | 247.586 | | | | .000091 | -6.46279 | -6.43827 | -6.40145 |
| 1 | 251.433 | 7.6934* | 1 | 0.006 | .000085* | -6.5377* | -6.50093* | -6.4457* |
| 2 | 252.196 | 1.5265 | 1 | 0.217 | .000085 | -6.53147 | -6.48244 | -6.4088 |
| 3 | 252.493 | .59355 | 1 | 0.441 | .000087 | -6.51296 | -6.45168 | -6.35962 |
| 4 | 252.522 | .058 | 1 | 0.810 | .000089 | -6.48741 | -6.41387 | -6.3034 |

Endogenous: D.lm

Exogenous: L.lm _cons

. varsoc d.r, exo(l.r) maxlag(4)

-----> ラグ次数の決定

Selection-order criteria

Sample: 6 - 81

Number of obs

=

76

| lag | LL | LR | df | p | FPE | AIC | HQIC | SBIC |
|-----|---------|---------|----|-------|----------|-----------|-----------|-----------|
| 0 | 81.6758 | | | | .007193 | -2.09673 | -2.07222 | -2.0354 |
| 1 | 87.9389 | 12.526* | 1 | 0.000 | .006263* | -2.23523* | -2.19847* | -2.14323* |
| 2 | 88.3361 | .79443 | 1 | 0.373 | .006364 | -2.21937 | -2.17035 | -2.0967 |
| 3 | 89.1945 | 1.7169 | 1 | 0.190 | .006388 | -2.21565 | -2.15436 | -2.06231 |
| 4 | 89.62 | .85091 | 1 | 0.356 | .006486 | -2.20053 | -2.12699 | -2.01652 |

Endogenous: D. r

Exogenous: L. r _cons

. dfuller lrgdp, lags(1) ———> ADF 検定

Augmented Dickey-Fuller test for unit root Number of obs = 79

| Test Statistic | Interpolated Dickey-Fuller | | | |
|-------------------|----------------------------|----------------------|-----------------------|--------|
| | 1% Critical Value | 5% Critical Value | 10% Critical Value | |
| Z(t) | -1.447 | -3.539 | -2.907 | -2.588 |

MacKinnon approximate p-value for Z(t) = 0.5593

. dfuller lm, lags(1) -----> ADF 検定

Augmented Dickey-Fuller test for unit root Number of obs = 79

| | Test Statistic | Interpolated Dickey-Fuller | | |
|------|-------------------|----------------------------|----------------------|-----------------------|
| | | 1% Critical Value | 5% Critical Value | 10% Critical Value |
| Z(t) | -3.308 | -3.539 | -2.907 | -2.588 |

MacKinnon approximate p-value for Z(t) = 0.0145

. dfuller r, lags(1) -----> ADF 検定

Augmented Dickey-Fuller test for unit root Number of obs = 79

| | Test Statistic | Interpolated Dickey-Fuller | | |
|------|-------------------|----------------------------|----------------------|-----------------------|
| | | 1% Critical Value | 5% Critical Value | 10% Critical Value |
| Z(t) | -3.442 | -3.539 | -2.907 | -2.588 |

MacKinnon approximate p-value for Z(t) = 0.0096

| | | | | | | | | |
|---|---------|---------|---|-------|----------|-----------|-----------|-----------|
| 0 | 120.419 | | | | .002595 | -3.11629 | -3.09178 | -3.05496 |
| 1 | 125.176 | 9.5128* | 1 | 0.002 | .002351* | -3.21515* | -3.17838* | -3.12314* |
| 2 | 125.218 | .08437 | 1 | 0.771 | .002411 | -3.18994 | -3.14091 | -3.06727 |
| 3 | 125.281 | .12669 | 1 | 0.722 | .002471 | -3.16529 | -3.10401 | -3.01195 |
| 4 | 125.301 | .03964 | 1 | 0.842 | .002536 | -3.1395 | -3.06596 | -2.95549 |

Endogenous: D.residual

Exogenous: L.residual _cons

. dfuller res, lags(1) -----> ADF 検定

Augmented Dickey-Fuller test for unit root Number of obs = 79

| Test Statistic | Interpolated Dickey-Fuller | | | |
|----------------|----------------------------|-------------------|--------------------|--------|
| | 1% Critical Value | 5% Critical Value | 10% Critical Value | |
| Z(t) | -2.800 | -3.539 | -2.907 | -2.588 |

MacKinnon approximate p-value for Z(t) = 0.0583

-----> この統計表ではなく、講義ノート P.206 の表を使う。定数項を除く説明変数の数は2で、5%点を、(b)から探す。-3.80 < -2.800 なので、resには単位根あり。したがって、「reg lm l gdp r」は見せかけ回帰。

. vecrank lgdp lm r -----> Johansen のランク検定 (共和分の数) の準備

Johansen tests for cointegration
Trend: constant Number of obs = 79
Sample: 3 - 81 Lags = 2

| maximum rank | parms | LL | eigenvalue | trace statistic | 5% critical value |
|--------------|-------|-----------|------------|-----------------|-------------------|
| 0 | 12 | 592.23414 | . | 40.2466 | 29.68 |
| 1 | 17 | 600.92745 | 0.19755 | 22.8600 | 15.41 |
| 2 | 20 | 608.75098 | 0.17968 | 7.2129 | 3.76 |
| 3 | 21 | 612.35743 | 0.08726 | | |

-----> full rank のため, どの変数の間にも共和分関係はない

. vec lm lgdp r, lags(1) rank(1) -----> 試しに, rank 1 とし, 共和分ベクトルを推定

Vector error-correction model

Sample: 2 - 81

Number of obs = 80

AIC = -14.56203

Log likelihood = 590.4813

HQIC = -14.46653

Det(Sigma_ml) = 7.79e-11

SBIC = -14.32383

| Equation | Parms | RMSE | R-sq | chi2 | P>chi2 |
|----------|-------|---------|--------|----------|--------|
| D_lm | 2 | .008728 | 0.7584 | 244.9046 | 0.0000 |
| D_lgdp | 2 | .010751 | 0.0580 | 4.800744 | 0.0907 |
| D_r | 2 | .098395 | 0.1201 | 10.6463 | 0.0049 |

| | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|-------|-----------|-----------|-------|-------|----------------------|-----------|
| D_lm | | | | | | |
| _ce1 | | | | | | |
| L1. | -.0134883 | .0019857 | -6.79 | 0.000 | -.0173801 | -.0095965 |
| _cons | -.0044268 | .0028494 | -1.55 | 0.120 | -.0100115 | .0011578 |

| | | | | | | | |
|--------|-----|-----------|----------|-------|-------|-----------|----------|
| D_lgdp | | | | | | | |
| _ce1 | L1. | -.0027241 | .0024459 | -1.11 | 0.265 | -.007518 | .0020698 |
| _cons | | -.0014045 | .0035098 | -0.40 | 0.689 | -.0082835 | .0054746 |
| D_r | | | | | | | |
| _ce1 | L1. | .0232136 | .0223846 | 1.04 | 0.300 | -.0206594 | .0670866 |
| _cons | | -.002737 | .0321212 | -0.09 | 0.932 | -.0656935 | .0602194 |

Cointegrating equations

| Equation | Parms | chi2 | P>chi2 |
|----------|-------|----------|--------|
| _ce1 | 2 | 20.11249 | 0.0000 |

Identification: beta is exactly identified

Johansen normalization restriction imposed

| beta | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|-------|-----------|-----------|------|-------|----------------------|----------|
| _ce1 | | | | | | |
| lm | 1 | | | | | |
| lgdp | 9.952711 | 2.318067 | 4.29 | 0.000 | 5.409383 | 14.49604 |
| r | .8054549 | .1936352 | 4.16 | 0.000 | .4259368 | 1.184973 |
| _cons | -146.4102 | | | | | |

. vec lm lgdp r, lags(1) rank(2) -----> 試しに, rank 2 とし, 共和分ベクトルを推定

Vector error-correction model

Sample: 2 - 81

Number of obs = 80
AIC = -14.66647
HQIC = -14.53515
SBIC = -14.33894

Log likelihood = 597.6587

Det(Sigma_ml) = 6.51e-11

| Equation | Parms | RMSE | R-sq | chi2 | P>chi2 |
|----------|-------|---------|--------|----------|--------|
| D_lm | 3 | .008772 | 0.7591 | 242.6941 | 0.0000 |
| D_lgdp | 3 | .010803 | 0.0612 | 5.017937 | 0.1705 |
| D_r | 3 | .091114 | 0.2552 | 26.37991 | 0.0000 |

| | | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|--------|-------------|-----------|-----------|-------|-------|----------------------|-----------|
| D_lm | | | | | | | |
| | _ce1 L1. | -.0140213 | .0022909 | -6.12 | 0.000 | -.0185114 | -.0095313 |
| | _ce2 L1. | -.1375614 | .021059 | -6.53 | 0.000 | -.1788362 | -.0962865 |
| | _cons | .0000794 | .002281 | 0.03 | 0.972 | -.0043913 | .0045502 |
| D_lgdp | | | | | | | |
| | _ce1 L1. | -.003434 | .0028212 | -1.22 | 0.224 | -.0089635 | .0020954 |
| | _ce2 L1. | -.031529 | .0259335 | -1.22 | 0.224 | -.0823577 | .0192998 |
| | _cons | -.0003526 | .002809 | -0.13 | 0.900 | -.0058582 | .005153 |
| D_r | | | | | | | |
| | _ce1 L1. | -.020455 | .0237953 | -0.86 | 0.390 | -.067093 | .026183 |

| | | | | | | | |
|-------|--|------------|-----------|--------|--------|------------|-----------|
| _ce2 | | | | | | | |
| L1. | | -. 0406369 | . 2187371 | -0. 19 | 0. 853 | -. 4693537 | . 3880799 |
| _cons | | 4. 76e-06 | . 0236928 | 0. 00 | 1. 000 | -. 0464323 | . 0464418 |

Cointegrating equations

| Equation | Parms | chi2 | P>chi2 |
|----------|-------|-----------|---------|
| ----- | | | |
| _ce1 | 1 | 20. 26361 | 0. 0000 |
| _ce2 | 1 | 13. 07767 | 0. 0003 |
| ----- | | | |

Identification: beta is exactly identified

Johansen normalization restrictions imposed

| | beta | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|------|-------|-----------|-----------|-------|-------|----------------------|-----------|
| _ce1 | lm | 1 | . | . | . | . | . |
| | lgdp | 0 | (omitted) | . | . | . | . |
| | r | 4.660158 | 1.035243 | 4.50 | 0.000 | 2.63112 | 6.689197 |
| | _cons | -18.83522 | . | . | . | . | . |
| _ce2 | lm | 0 | (omitted) | . | . | . | . |
| | lgdp | 1 | . | . | . | . | . |
| | r | -.3873018 | .1070988 | -3.62 | 0.000 | -.5972115 | -.1773921 |
| | _cons | -12.78548 | . | . | . | . | . |