estat covariance — Display estimated covariances of model variables

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Description

estat covariance displays model-implied covariances between control variables.

Quick start

Display variances and covariances of all control variables in the model

```
estat covariance
```

Include only variances and covariances of x and its lag

```
estat covariance x L.x
```

Display the variance of x1 and the covariance of x1 with the lag of x1 and with x2

```
estat covariance x1, addcovariance(L.x1 x2)
```

Menu for estat

Statistics > Postestimation

Syntax

estat covariance [*varlist*] [, *options*]

varlist may include control variables and their lags. If *varlist* is not specified, variances and covariances are reported for all control variables in the model.

options	Description
addcovariance(*clistc*)	report additional covariances
nocovariance	do not report covariances
post	post variances and covariances and their VCE as estimation results
level(#)	set confidence level; default is level(95)
display_options	control columns and column formats and line width

collect is allowed; see **[U] 11.1.10 Prefix commands**.

Options

addcovariance(*clistc*) specifies that the covariances between the control variables specified in *clistc* and those specified in *varlist* be displayed. The variances of variables in *clistc* are not reported. *clistc* can contain lags of the control variables in the model.

nocovariance specifies that no covariance be displayed. nocovariance may not be specified with addcovariance().

`post` causes `estat covariance` to behave like a Stata estimation (e-class) command. `estat covariance` posts the estimated variance–covariance matrix to `e()`, so you can treat it just as you would results from any other estimation command.

`level(#)` specifies the confidence level, as a percentage, for confidence intervals. The default is `level(95)` or as set by `set level`; see [U] **20.8 Specifying the width of confidence intervals**.

display_options: `noci`, `nopvalues`, `cformat(%`*fmt*`)`, `pformat(%`*fmt*`)`, `sformat(%`*fmt*`)`, and `nolstretch`; see [R] **Estimation options**.

Remarks and examples

`estat covariance` displays covariances between control variables implied by a DSGE model.

We provide examples of the use of `estat covariance` using the model from [DSGE] **Intro 3e**. In that introduction, we estimated some of the parameters of a Real Business Cycle model. Model setup and estimation were given by

```
. use https://www.stata-press.com/data/r19/usmacro2
(Federal Reserve Economic Data - St. Louis Fed, 2017-01-15)
. constraint 1 _b[alpha] = 0.33
. constraint 2 _b[beta]  = 0.99
. constraint 3 _b[delta] = 0.025
. constraint 4 _b[chi]   = 2
. dsgenl (1/c = {beta}*(1/F.c)*(1+r-{delta}))
>        ({chi}*h = w/c)
>        (y   = c + i)
>        (y   = z*k^{alpha}*h^(1-{alpha}))
>        (r   = {alpha}*y/k)
>        (w   = (1-{alpha})*y/h)
>        (F.k = i + (1-{delta})*k)
>        (ln(F.z) = {rho}*ln(z))
>        , observed(y) unobserved(c i r w h) exostate(z) endostate(k)
>        constraint(1/4) nolog
Solving at initial parameter vector ...
Checking identification ...
First-order DSGE model
Sample: 1955q1 thru 2015q4                          Number of obs = 244
Log likelihood = -639.38787
 ( 1)  [/structural]alpha = .33
 ( 2)  [/structural]beta = .99
 ( 3)  [/structural]delta = .025
 ( 4)  [/structural]chi = 2
```

y	Coefficient	Std. err.	z	P>|z|	[95% conf. interval]	
/structural						
beta	.99	(constrained)				
delta	.025	(constrained)				
chi	2	(constrained)				
alpha	.33	(constrained)				
rho	.3132838	.0614709	5.10	0.000	.192803	.4337646
sd(e.z)	2.249022	.101853			2.049394	2.44865

The commands just listed imported data, set up constraints, and estimated the remaining model parameters. For details of the model, see [DSGE] **Intro 3e**. The control variables in this model are `c`, `i`, `r`, `w`, `h`, and `y`.

By default, `estat covariance` displays the contemporaneous variances and covariances of all the control variables in the model.

```
. estat covariance
```

Estimated covariances of model variables

	Coefficient	Delta-method std. err.	z	P>|z|	[95% conf.	interval]
c						
var(c)	.8569582	.1674995	5.12	0.000	.5286652	1.185251
cov(c,i)	1.700528	.4329933	3.93	0.000	.8518764	2.549179
cov(c,r)	-.4155731	.0553716	-7.51	0.000	-.5240994	-.3070467
cov(c,w)	.9560928	.198436	4.82	0.000	.5671653	1.34502
cov(c,h)	.0991346	.031423	3.15	0.002	.0375466	.1607226
cov(c,y)	1.055227	.2295048	4.60	0.000	.6054062	1.505049
i						
var(i)	208.0512	20.07879	10.36	0.000	168.6975	247.4049
cov(i,r)	50.26689	4.824216	10.42	0.000	40.8116	59.72218
cov(i,w)	25.95045	2.626602	9.88	0.000	20.8024	31.09849
cov(i,h)	24.24992	2.32649	10.42	0.000	19.69008	28.80975
cov(i,y)	50.20036	4.943248	10.16	0.000	40.51178	59.88895
r						
var(r)	12.95503	1.275345	10.16	0.000	10.4554	15.45466
cov(r,w)	5.540528	.5242116	10.57	0.000	4.513092	6.567963
cov(r,h)	5.956101	.5726953	10.40	0.000	4.833639	7.078563
cov(r,y)	11.49663	1.096581	10.48	0.000	9.34737	13.64589
w						
var(w)	3.893379	.4600228	8.46	0.000	2.991751	4.795007
cov(w,h)	2.937286	.29054	10.11	0.000	2.367838	3.506734
cov(w,y)	6.830665	.7434327	9.19	0.000	5.373564	8.287766
h						
var(h)	2.838151	.2712547	10.46	0.000	2.306502	3.369801
cov(h,y)	5.775437	.5612467	10.29	0.000	4.675414	6.875461
y						
var(y)	12.6061	1.297192	9.72	0.000	10.06365	15.14855

Applied studies frequently look at the variances and covariances of a subset of the control variables in the model. Studies also frequently look at the covariances between a subset of the control variables in the model and the lags of one or two control variables. We illustrate how to obtain these results.

To view only the variance of the consumption c and its covariance with the control variables in the model, type

```
. estat covariance c, addcovariance(i r w h y)
Estimated covariances of model variables
```

	Coefficient	Delta-method std. err.	z	P>|z|	[95% conf.	interval]
c						
var(c)	.8569582	.1674995	5.12	0.000	.5286652	1.185251
cov(c,i)	1.700528	.4329933	3.93	0.000	.8518764	2.549179
cov(c,r)	-.4155731	.0553716	-7.51	0.000	-.5240994	-.3070467
cov(c,w)	.9560928	.198436	4.82	0.000	.5671653	1.34502
cov(c,h)	.0991346	.031423	3.15	0.002	.0375466	.1607226
cov(c,y)	1.055227	.2295048	4.60	0.000	.6054062	1.505049

Autocovariances are available as well. To view the variance of output and the first-order autocovariance of output, type

```
. estat covariance y, addcovariance(L.y)
Estimated covariances of model variables
```

	Coefficient	Delta-method std. err.	z	P>|z|	[95% conf.	interval]
y						
var(y)	12.6061	1.297192	9.72	0.000	10.06365	15.14855
cov(y,L.y)	4.370091	1.077205	4.06	0.000	2.258808	6.481374

To view the variances and covariance of output and consumption as well as their covariances with lagged output and lagged consumption, type

```
. estat covariance y c, addcovariance(L.y L.c)
Estimated covariances of model variables
```

	Coefficient	Delta-method std. err.	z	P>|z|	[95% conf.	interval]
y						
var(y)	12.6061	1.297192	9.72	0.000	10.06365	15.14855
cov(y,c)	1.055227	.2295048	4.60	0.000	.6054062	1.505049
cov(y,L.y)	4.370091	1.077205	4.06	0.000	2.258808	6.481374
cov(y,L.c)	1.000102	.2569841	3.89	0.000	.4964225	1.503782
c						
var(c)	.8569582	.1674995	5.12	0.000	.5286652	1.185251
cov(y,c)	1.055227	.2295048	4.60	0.000	.6054062	1.505049
cov(c,L.y)	1.000102	.1561667	6.40	0.000	.694021	1.306183
cov(c,L.c)	.842517	.1656435	5.09	0.000	.5178617	1.167172

What we typed requested the covariance between y and the lag of c (cov(y,L.c)) and between c and the lag of y (cov(c,L.y)). In general, these covariances can be different. The structure in this model causes their estimates to be the same, but their estimated standard errors are different. The estimated standard errors differ because the derivatives that enter the delta method are different.

Stored results

`estat covariance` stores the following in `r()`:

Matrices	
`r(b)`	estimates
`r(V)`	variance–covariance matrix of the estimates

If `post` is specified, `estat covariance` also stores the following in `e()`:

Macros	
`e(properties)`	`b V`
Matrices	
`e(b)`	estimates
`e(V)`	variance–covariance matrix of the estimates

Methods and formulas

Entries in the covariance matrix are functions of the structural parameter vector θ. Standard errors are calculated using the delta method.

Also see

[DSGE] **dsgenl** — Nonlinear dynamic stochastic general equilibrium models

[DSGE] **dsgenl postestimation** — Postestimation tools for dsgenl

[DSGE] **Intro 3e** — Nonlinear New Classical model

For suggested citations, see the FAQ on citing Stata documentation.