Title

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estat covariance — Display estimated covariances of model variables

Description

`estat covariance` displays model-implied covariances among 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

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

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`estat covariance` displays covariances among 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/r16/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 - 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	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
/structural						
beta	.99	(constrained)				
delta	.025	(constrained)				
chi	2	(constrained)				
alpha	.33	(constrained)				
rho	.3132837	.0614709	5.10	0.000	.1928029	.4337645
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
```

	Delta-method Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
c						
var(c)	.8564586	.1674129	5.12	0.000	.5283354	1.184582
cov(c,i)	1.699536	.432758	3.93	0.000	.8513461	2.547726
cov(c,r)	-.4153308	.055347	-7.50	0.000	-.523809	-.3068527
cov(c,w)	.9555354	.198332	4.82	0.000	.5668118	1.344259
cov(c,h)	.0990768	.0314055	3.15	0.002	.0375231	.1606305
cov(c,y)	1.054612	.2293833	4.60	0.000	.6050292	1.504195
i						
var(i)	207.93	20.07228	10.36	0.000	168.589	247.2709
cov(i,r)	50.23759	4.822667	10.42	0.000	40.78534	59.68985
cov(i,w)	25.93532	2.625692	9.88	0.000	20.78906	31.08158
cov(i,h)	24.23579	2.325743	10.42	0.000	19.67741	28.79416
cov(i,y)	50.17111	4.941598	10.15	0.000	40.48575	59.85646
r						
var(r)	12.94748	1.274919	10.16	0.000	10.44869	15.44628
cov(r,w)	5.537299	.524047	10.57	0.000	4.510185	6.564412
cov(r,h)	5.95263	.5725108	10.40	0.000	4.830529	7.07473
cov(r,y)	11.48993	1.096232	10.48	0.000	9.341353	13.6385
w						
var(w)	3.89111	.4598352	8.46	0.000	2.989849	4.79237
cov(w,h)	2.935574	.2904425	10.11	0.000	2.366317	3.504831
cov(w,y)	6.826684	.743152	9.19	0.000	5.370133	8.283235
h						
var(h)	2.836497	.2711682	10.46	0.000	2.305017	3.367977
cov(h,y)	5.772071	.561063	10.29	0.000	4.672408	6.871735
y						
var(y)	12.59876	1.296733	9.72	0.000	10.05721	15.14031

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
```

	Coef.	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
c						
var(c)	.8564586	.1674129	5.12	0.000	.5283354	1.184582
cov(c,i)	1.699536	.432758	3.93	0.000	.8513461	2.547726
cov(c,r)	-.4153308	.055347	-7.50	0.000	-.523809	-.3068527
cov(c,w)	.9555354	.198332	4.82	0.000	.5668118	1.344259
cov(c,h)	.0990768	.0314055	3.15	0.002	.0375231	.1606305
cov(c,y)	1.054612	.2293833	4.60	0.000	.6050292	1.504195

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
```

	Coef.	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
y						
var(y)	12.59876	1.296733	9.72	0.000	10.05721	15.14031
cov(y,L.y)	4.367543	1.076622	4.06	0.000	2.257402	6.477685

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
```

	Coef.	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
y						
var(y)	12.59876	1.296733	9.72	0.000	10.05721	15.14031
cov(y,c)	1.054612	.2293833	4.60	0.000	.6050292	1.504195
cov(y,L.y)	4.367543	1.076622	4.06	0.000	2.257402	6.477685
cov(y,L.c)	.9995189	.2568548	3.89	0.000	.4960927	1.502945
c						
var(c)	.8564586	.1674129	5.12	0.000	.5283354	1.184582
cov(y,c)	1.054612	.2293833	4.60	0.000	.6050292	1.504195
cov(c,L.y)	.9995189	.1560805	6.40	0.000	.6936067	1.305431
cov(c,L.c)	.8420259	.1655577	5.09	0.000	.5175387	1.166513

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