## Postestimation commands

The following postestimation commands are of special interest after ucm:

| Command | Description |
|---------|-------------|
| estat period | display cycle periods in time units |
| psdensity | estimate the spectral density |

The following standard postestimation commands are also available:

| Command | Description |
|---------|-------------|
| estat ic | Akaike's, consistent Akaike's, corrected Akaike's, and Schwarz's Bayesian information criteria (AIC, CAIC, AICc, and BIC, respectively) |
| estat summarize | summary statistics for the estimation sample |
| estat vce | variance–covariance matrix of the estimators (VCE) |
| estimates | cataloging estimation results |
| etable | table of estimation results |
| forecast | dynamic forecasts and simulations |
| lincom | point estimates, standard errors, testing, and inference for linear combinations of parameters |
| lrtest | likelihood-ratio test |
| nlcom | point estimates, standard errors, testing, and inference for nonlinear combinations of parameters |
| predict | linear predictions, trend components, seasonal components, cycle components, residuals, etc. |
| predictnl | point estimates, standard errors, testing, and inference for generalized predictions |
| test | Wald tests of simple and composite linear hypotheses |
| testnl | Wald tests of nonlinear hypotheses |

# predict

## Description for predict

predict creates a new variable containing predictions such as linear predictions, trend components, seasonal components, cyclical components, and standardized and unstandardized residuals. The root mean squared error is available for all predictions. All predictions are also available as static one-step-ahead predictions or as dynamic multistep predictions, and you can control when dynamic predictions begin.

## Menu for predict

Statistics > Postestimation

## Syntax for predict

predict [ *type* ] { *stub*\* | *newvarlist* } [ *if* ] [ *in* ] [ , *statistic options* ]

| *statistic* | Description |
|---|---|
| Main | |
| xb | linear prediction using exogenous variables |
| trend | trend component |
| seasonal | seasonal component |
| cycle | cyclical component |
| residuals | residuals |
| rstandard | standardized residuals |

These statistics are available both in and out of sample; type predict ... if e(sample) ... if wanted only for the estimation sample.

| *options* | Description |
|---|---|
| Options | |
| rmse(*stub*\* \| *newvarlist*) | put estimated root mean squared errors of predicted statistics in the new variable |
| dynamic(*time_constant*) | begin dynamic forecast at specified time |
| Advanced | |
| smethod(*method*) | method for predicting unobserved components |

| *method* | Description |
|---|---|
| onestep | predict using past information |
| smooth | predict using all sample information |
| filter | predict using past and contemporaneous information |

## Options for predict

___ Main ___

xb, trend, seasonal, cycle, residuals, and rstandard specify the statistic to be predicted.

   xb, the default, calculates the linear predictions using the exogenous variables. xb may not be used
      with the smethod(filter) option.

   trend estimates the unobserved trend component.

   seasonal estimates the unobserved seasonal component.

   cycle estimates the unobserved cyclical component.

   residuals calculates the residuals in the equation for the dependent variable. residuals may not
      be specified with dynamic().

   rstandard calculates the standardized residuals, which are the residuals normalized to have unit
      variances. rstandard may not be specified with the smethod(filter), smethod(smooth), or
      dynamic() option.

___ Options ___

rmse(*stub* * | *newvarlist*) puts the root mean squared errors of the predicted statistic into the specified
   new variable. Multiple variables are only required for predicting cycles of a model that has more than
   one cycle. The root mean squared errors measure the variances due to the disturbances but do not
   account for estimation error. The *stub* * syntax is for models with multiple cycles, where you provide
   the prefix and predict will add a numeric suffix for each predicted cycle.

dynamic(*time_constant*) specifies when predict should start producing dynamic forecasts. The speci-
   fied *time_constant* must be in the scale of the time variable specified in tsset, and the *time_constant*
   must be inside a sample for which observations on the dependent variable are available. For example,
   dynamic(tq(2008q4)) causes dynamic predictions to begin in the fourth quarter of 2008, assuming
   that your time variable is quarterly; see [D] **Datetime**. If the model contains exogenous variables,
   they must be present for the whole predicted sample. dynamic() may not be specified with the
   rstandard, residuals, or smethod(smooth) option.

___ Advanced ___

smethod(*method*) specifies the method for predicting the unobserved components. smethod() causes
   different amounts of information on the dependent variable to be used in predicting the components
   at each time period.

   smethod(onestep), the default, causes predict to estimate the components at each time period
      using previous information on the dependent variable. The Kalman filter is performed on previous
      periods, but only the one-step predictions are made for the current period.

   smethod(smooth) causes predict to estimate the components at each time period using all the sam-
      ple data by the Kalman smoother. smethod(smooth) may not be specified with the rstandard
      option.

   smethod(filter) causes predict to estimate the components at each time period using previous
      and contemporaneous data by the Kalman filter. The Kalman filter is performed on previous peri-
      ods and the current period. smethod(filter) may not be specified with the xb option.

# estat

## Description for estat

estat period transforms an estimated central frequency to an estimated period after ucm.

## Menu for estat

Statistics > Postestimation

## Syntax for estat

estat <u>period</u> [ , *options* ]

| *options* | Description |
|-----------|-------------|
| cformat(*%fmt*) | specify numeric format |
| <u>level</u>(#) | set confidence level; default is level(95) |

## Options for estat period

cformat(*%fmt*) sets the display format for the table numeric values. The default is cformat(%9.0g).

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**.

## Remarks and examples

We assume that you have already read [TS] **ucm**. In this entry, we illustrate some features of predict after using ucm to estimate the parameters of an unobserved-components model.

All predictions after ucm depend on the unobserved components, which are estimated recursively using a Kalman filter. Changing the sample can alter the state estimates, which can change all other predictions.

▷ Example 1

We begin by modeling monthly data on the median duration of employment spells in the United States. We include a stochastic-seasonal component because the data have not been seasonally adjusted.

```
. use https://www.stata-press.com/data/r19/uduration2
(BLS data, not seasonally adjusted)

. ucm duration, seasonal(12) cycle(1) difficult
searching for initial values ...................
(setting technique to bhhh)
Iteration 0:  Log likelihood = -409.79649
Iteration 1:  Log likelihood = -403.38335
Iteration 2:  Log likelihood = -403.37399  (backed up)
Iteration 3:  Log likelihood = -403.36926  (backed up)
Iteration 4:  Log likelihood = -403.36689  (backed up)
(switching technique to nr)
Iteration 5:  Log likelihood = -403.36674  (backed up)
Iteration 6:  Log likelihood = -397.87755  (not concave)
Iteration 7:  Log likelihood =  -395.5778  (not concave)
Iteration 8:  Log likelihood = -390.45932  (not concave)
Iteration 9:  Log likelihood = -389.47811  (not concave)
Iteration 10: Log likelihood = -388.88244  (not concave)
Iteration 11: Log likelihood =   -388.536
Iteration 12: Log likelihood = -388.30418
Iteration 13: Log likelihood = -388.25717
Iteration 14: Log likelihood = -388.25675
Iteration 15: Log likelihood = -388.25675
Refining estimates:
Iteration 0:  Log likelihood = -388.25675
Iteration 1:  Log likelihood = -388.25675

Unobserved-components model
Components: random walk, seasonal(12), order 1 cycle
Sample: 1967m7 thru 2008m12                    Number of obs =     498
                                               Wald chi2(2)  =    7.17
Log likelihood = -388.25675                    Prob > chi2   =  0.0277
```

| duration | Coefficient | Std. err. | z | P>\|z\| | [95% conf. interval] | |
|---|---|---|---|---|---|---|
| frequency | 1.641531 | .7250324 | 2.26 | 0.024 | .2204935 | 3.062568 |
| damping | .2671232 | .1050168 | 2.54 | 0.011 | .0612939 | .4729524 |
| var(level) | .1262922 | .0221428 | 5.70 | 0.000 | .0828932 | .1696912 |
| var(seasonal) | .0017289 | .0009647 | 1.79 | 0.037 | 0 | .0036196 |
| var(cycle1) | .0641496 | .0211839 | 3.03 | 0.001 | .0226299 | .1056694 |

Note: Model is not stationary.
Note: Tests of variances against zero are one sided, and the two-sided
      confidence intervals are truncated at zero.

Below we predict the trend and the seasonal components to get a look at the model fit.

```
. predict strend, trend
. predict season, seasonal
. tsline duration strend, name(trend) nodraw legend(rows(1))
. tsline season, name(season) yline(0,lwidth(vthin)) nodraw
. graph combine trend season, rows(2)
```
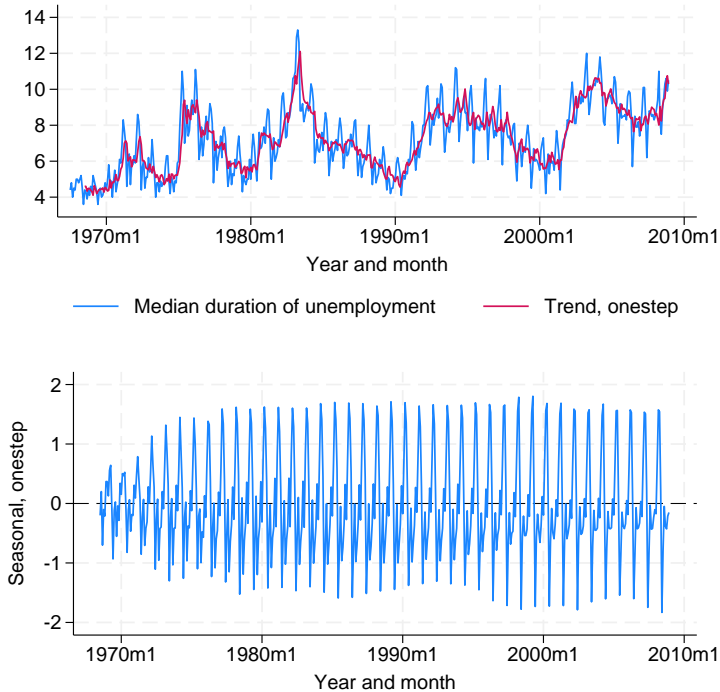


The trend tracks the data well. That the seasonal component appears to change over time indicates that the stochastic-seasonal component might fit better than a deterministic-seasonal component.

▷ Example 2

In this example, we use the model to forecast the median unemployment duration. We use the root mean squared error of the prediction to compute a confidence interval of our dynamic predictions. Recall that the root mean squared error accounts for variances due to the disturbances but not due to the estimation error.

```
. tsappend, add(12)
. predict duration_f, dynamic(tm(2009m1)) rmse(rmse)
. scalar z = invnormal(0.95)
. generate lbound = duration_f - z*rmse if tm>=tm(2008m12)
(497 missing values generated)
. generate ubound = duration_f + z*rmse if tm>=tm(2008m12)
(497 missing values generated)
. label variable lbound "90% forecast interval"
. tsline duration duration_f if tm>=tm(2006m1) ||
> tsrline lbound ubound if tm>=tm(2008m12),
> ysize(2) xtitle("") legend(cols(1))
```
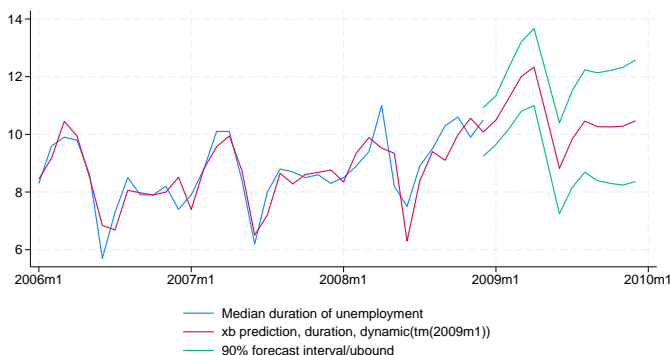


The model forecasts a large temporary increase in the median duration of unemployment.

◁

# Methods and formulas

For details on the ucm postestimation methods, see [TS] **sspace postestimation**.

See [TS] **psdensity** for the methods used to estimate the spectral density.

# Also see

[TS] **ucm** — Unobserved-components model

[TS] **psdensity** — Parametric spectral density estimation after arima, arfima, and ucm

[TS] **sspace postestimation** — Postestimation tools for sspace

[U] **20 Estimation and postestimation commands**

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