

# Econometrics Toolbox™ Release Notes



# MATLAB®

# How to Contact MathWorks



Latest news: [www.mathworks.com](http://www.mathworks.com)  
Sales and services: [www.mathworks.com/sales\\_and\\_services](http://www.mathworks.com/sales_and_services)  
User community: [www.mathworks.com/matlabcentral](http://www.mathworks.com/matlabcentral)  
Technical support: [www.mathworks.com/support/contact\\_us](http://www.mathworks.com/support/contact_us)



Phone: 508-647-7000



The MathWorks, Inc.  
3 Apple Hill Drive  
Natick, MA 01760-2098

## *Econometrics Toolbox™ Release Notes*

© COPYRIGHT 2005–2018 by The MathWorks, Inc.

The software described in this document is furnished under a license agreement. The software may be used or copied only under the terms of the license agreement. No part of this manual may be photocopied or reproduced in any form without prior written consent from The MathWorks, Inc.

FEDERAL ACQUISITION: This provision applies to all acquisitions of the Program and Documentation by, for, or through the federal government of the United States. By accepting delivery of the Program or Documentation, the government hereby agrees that this software or documentation qualifies as commercial computer software or commercial computer software documentation as such terms are used or defined in FAR 12.212, DFARS Part 227.72, and DFARS 252.227-7014. Accordingly, the terms and conditions of this Agreement and only those rights specified in this Agreement, shall pertain to and govern the use, modification, reproduction, release, performance, display, and disclosure of the Program and Documentation by the federal government (or other entity acquiring for or through the federal government) and shall supersede any conflicting contractual terms or conditions. If this License fails to meet the government's needs or is inconsistent in any respect with federal procurement law, the government agrees to return the Program and Documentation, unused, to The MathWorks, Inc.

### **Trademarks**

MATLAB and Simulink are registered trademarks of The MathWorks, Inc. See [www.mathworks.com/trademarks](http://www.mathworks.com/trademarks) for a list of additional trademarks. Other product or brand names may be trademarks or registered trademarks of their respective holders.

### **Patents**

MathWorks products are protected by one or more U.S. patents. Please see [www.mathworks.com/patents](http://www.mathworks.com/patents) for more information.

## R2018b

<b>armafevd Function: Estimate the forecast error variance decomposition (FEVD) for VARMA models</b> .....	<b>1-2</b>
<b>Bayesian Linear Regression: Perform Bayesian variable selection for dimensionality reduction</b> .....	<b>1-2</b>
<b>Econometric Modeler App: Exclude intercept from linear models or regression models with ARMA errors</b> .....	<b>1-3</b>
<b>Bayesian Linear Regression: Access covariance estimates from estimation summary tables</b> .....	<b>1-4</b>
<b>armairf Function: Supply or return graphics object handles</b> .....	<b>1-4</b>
<b>Functionality being removed or changed</b> .....	<b>1-5</b>
armairf returns separate figures for each variable in the system .....	<b>1-5</b>
armairf permutes the second and third dimensions of the impulse response array output .....	<b>1-5</b>
estimate will return only an estimated model object and estimation summary .....	<b>1-6</b>

## R2018a

<b>Econometric Modeler App: Perform time series analysis, specification testing, modeling, and diagnostics</b> .....	<b>2-2</b>
--	------------

<b>Missing Data Support: Autocorrelation, partial autocorrelation, and Ljung-Box Q-test calculations account for missing observations</b> .....	2-3
<b>Toolbox Plotting Functions: Supply or return graphics object handles</b> .....	2-3
<b>Model Summary: Display estimation results from fitting models</b> .....	2-3
<b>Model Description: Assign descriptions to econometric model objects</b> .....	2-4
<b>Model Lag Parameters: Use indices that are consistent with MATLAB cell array indexing</b> .....	2-4
<b>Model Distribution: Store innovation distribution name as string scalar</b> .....	2-5
<b>Functionality Being Removed or Changed</b> .....	2-5

## R2017b

<b>Discrete-Time Markov Chains: Analyze the structure and evolution of Markov models</b> .....	3-2
<b>Vector Error-Correction Model: Analyze multivariate time series with cointegrating relationships</b> .....	3-2
<b>Bayesian Linear Regression: Draw samples from posterior distributions using the Hamiltonian Monte Carlo sampler</b> .....	3-2
<b>New Data Set</b> .....	3-2

## R2017a

<b>Bayesian Linear Regression: Analyze posterior distributions of random parameters in multiple regression models . . . . .</b>	<b>4-2</b>
<b>Vector Autoregressive Model: Analyze multivariate time series data including exogenous predictors . . . . .</b>	<b>4-3</b>
<b>Functionality Being Removed or Changed . . . . .</b>	<b>4-3</b>

## R2016b

<b>Econometrics data folder renamed to econdata . . . . .</b>	<b>5-2</b>
---	------------

## R2016a

<b>Cusum Structural Change Tests: Assess stability of multiple linear regression models . . . . .</b>	<b>6-2</b>
<b>Recursive Linear Regression: Recursively estimate coefficients of multiple linear regression models . . . . .</b>	<b>6-2</b>
<b>Functionality being removed . . . . .</b>	<b>6-2</b>

## R2015b

<b>Model Conversion Functions: Convert between VEC models and VAR models . . . . .</b>	<b>7-2</b>
--	------------

<b>Diffuse Kalman Filter: Model state-space systems having diffuse initial state distributions</b> .....	7-2
<b>Chow Structural Change Test: Assess stability of multiple linear regression models</b> .....	7-2
<b>ARMAIRF Function: Calculate impulse responses for ARMA models</b> .....	7-2
<b>New Data Set</b> .....	7-3
<b>Functionality being removed</b> .....	7-3

## **R2015a**

<b>State-space example for Diebold-Li model</b> .....	8-2
<b>Autoregressive moving average (ARMA) to AR and MA conversions</b> .....	8-2
<b>Functionality being removed</b> .....	8-2

## **R2014b**

<b>Simulation smoothing for state-space models</b> .....	9-2
<b>Feasible generalized least squares (FGLS) estimators</b> .....	9-2
<b>Time-series regression example</b> .....	9-2
<b>Shipped data sets now support tabular arrays</b> .....	9-2
<b>Functions now support tabular arrays</b> .....	9-2

## R2014a

<b>Time-invariant and time-varying, linear, Gaussian state-space models</b> .....	<b>10-2</b>
<b>Kalman filter with missing data</b> .....	<b>10-2</b>
<b>Performance enhancements for ARIMA and GARCH models</b> .....	<b>10-2</b>
<b>SDE functions moved from Econometrics Toolbox to Financial Toolbox</b> .....	<b>10-2</b>
<b>Data set and example functions moved from Econometrics Toolbox to Financial Toolbox</b> .....	<b>10-3</b>
<b>Functionality being removed</b> .....	<b>10-4</b>

## R2013b

<b>Regression models with ARIMA errors</b> .....	<b>11-2</b>
<b>Time series regression example for lag order selection</b> .....	<b>11-2</b>
<b>optimoptions support</b> .....	<b>11-2</b>
<b>Estimation display options</b> .....	<b>11-3</b>
<b>Functionality being removed</b> .....	<b>11-3</b>

## R2013a

<b>Heteroscedasticity and autocorrelation consistent (HAC) covariance estimators</b> .....	<b>12-2</b>
<b>Regression component added to ARIMA models</b> .....	<b>12-2</b>
<b>Changes to lmctest</b> .....	<b>12-2</b>
<b>Functionality being removed</b> .....	<b>12-2</b>

## R2012b

<b>Impulse response (dynamic multipliers) for ARIMA models</b> .....	<b>13-2</b>
<b>Filter user-specified disturbances through ARIMA and conditional variance models</b> .....	<b>13-2</b>
<b>A series of new examples on time-series regression techniques</b> .....	<b>13-2</b>

## R2012a

<b>New Model Objects and Their Functions</b> .....	<b>14-2</b>
<b>New Utility Functions</b> .....	<b>14-2</b>
<b>Demo for Static Time Series Model Specification</b> .....	<b>14-2</b>
<b>New Data Sets</b> .....	<b>14-3</b>



## R2011b

---

<b>Warning and Error ID Changes</b> .....	<b>15-2</b>
---	-------------

## R2011a

---

<b>New Cointegration Functionality</b> .....	<b>16-2</b>
<b>Convert Vector Autoregressive Models to and from Vector Error-Correction Models</b> .....	<b>16-2</b>
<b>Data Sets for Calibrating Economic Models</b> .....	<b>16-2</b>

## R2010b

---

<b>Functions Being Removed</b> .....	<b>17-2</b>
<b>Additional Syntax Options for archtest and lbqtest</b> .....	<b>17-2</b>
<b>New Data Set for Calibrating Economic Models</b> .....	<b>17-3</b>

## R2010a

---

<b>Functions Being Removed</b> .....	<b>18-2</b>
<b>Demo Showing Multivariate Modeling of the U.S. Economy</b> .....	<b>18-2</b>
<b>Lag Operator Polynomial Objects</b> .....	<b>18-3</b>

<b>Leybourne-McCabe Test for Stationarity</b> .....	<b>18-3</b>
<b>Historical Data Sets for Calibrating Economic Models</b> .....	<b>18-3</b>
<b>New Organization and Naming Standard for Data Sets</b> .....	<b>18-3</b>
<b>New Naming Convention for Demos and Example Functions</b> .....	<b>18-4</b>

## **R2009b**

<b>Unit Root Tests</b> .....	<b>19-2</b>
Dickey-Fuller and Phillips-Perron Tests .....	<b>19-2</b>
KPSS Test .....	<b>19-2</b>
Variance Ratio Test .....	<b>19-2</b>
<b>Financial Toolbox Required</b> .....	<b>19-2</b>
<b>Nelson-Plosser Data</b> .....	<b>19-2</b>

## **R2009a**

<b>Hypothesis Tests</b> .....	<b>20-2</b>
<b>Structural VAR, VARX, and VARMAX models</b> .....	<b>20-2</b>
<b>New Demo</b> .....	<b>20-3</b>

## **R2008b**

<b>Multivariate VAR, VARX, and VARMA Models</b> .....	<b>21-2</b>
---	-------------

<b>Heston Stochastic Volatility Models .....</b>	<b>21-2</b>
--	-------------

**R2008a**

<b>Monte Carlo Simulation of Stochastic Differential Equations .....</b>	<b>22-2</b>
--	-------------

**R2007b**

<b>Changes to garchsim .....</b>	<b>23-2</b>
----------------------------------	-------------

**R2007a**

**No New Features or Changes**

**R2006b**

<b>Data Preprocessing .....</b>	<b>25-2</b>
<b>Demos .....</b>	<b>25-2</b>

## R2006a

---

<b>User's Guide</b> .....	<b>26-2</b>
<b>Statistical Functions</b> .....	<b>26-2</b>
Dickey-Fuller Unit Root Tests .....	<b>26-2</b>
Phillips-Perron Unit Root Tests .....	<b>26-2</b>

## R14SP3

---

<b>Changes to garchsim</b> .....	<b>27-2</b>
----------------------------------	-------------

# R2018b

---

**Version: 5.1**

**New Features**

**Bug Fixes**

**Compatibility Considerations**

## armafevd Function: Estimate the forecast error variance decomposition (FEVD) for VARMA models

The `armafevd` function estimates the contributions to the forecast error variance of each variable in a multivariate vector autoregressive, moving average (VARMA) model. The forecast error variance results from shocks to all variables in the system. `armafevd` returns the FEVD as a numeric array or in separate figures for each variable.

## Bayesian Linear Regression: Perform Bayesian variable selection for dimensionality reduction

The `bayeslm` function supports the creation of additional Bayesian linear regression model objects suitable for variable (predictor or feature) selection. The additional objects impose an inverse gamma prior distribution on the disturbance variance ( $\sigma^2$ ), but three alternative priors on the regression coefficients ( $\beta$ ) are available, as described in this table.

Model Object	Description
<code>mixconjugateblm</code>	<ul style="list-style-type: none"> <li>The variable selection algorithm is stochastic search variable selection (SSVS).</li> <li>The data likelihood, prior distribution, and posterior distributions compose a conjugate Gaussian mixture model.</li> <li><math>\beta</math> and <math>\sigma^2</math> are dependent random variables.</li> </ul>
<code>mixsemiconjugateblm</code>	<ul style="list-style-type: none"> <li>The variable selection algorithm is SSVS.</li> <li>The data likelihood, prior distribution, and the prior and posterior distributions compose a semiconjugate Gaussian mixture model.</li> <li><math>\beta</math> and <math>\sigma^2</math> are independent random variables.</li> </ul>
<code>lassoblmm</code>	<ul style="list-style-type: none"> <li>The variable selection method is shrinkage estimation by Bayesian lasso regression.</li> <li>Conditioned on <math>\sigma^2</math>, the prior distribution of each regression coefficient is double exponential with a mean of 0 and scale <math>\sigma/\lambda</math>, where <math>\lambda</math> is the lasso shrinkage parameter. As <math>\lambda</math> increases, the coefficients tend towards 0.</li> <li><math>\beta</math> and <math>\sigma^2</math> are dependent random variables. Regression coefficients are independent, a priori.</li> </ul>

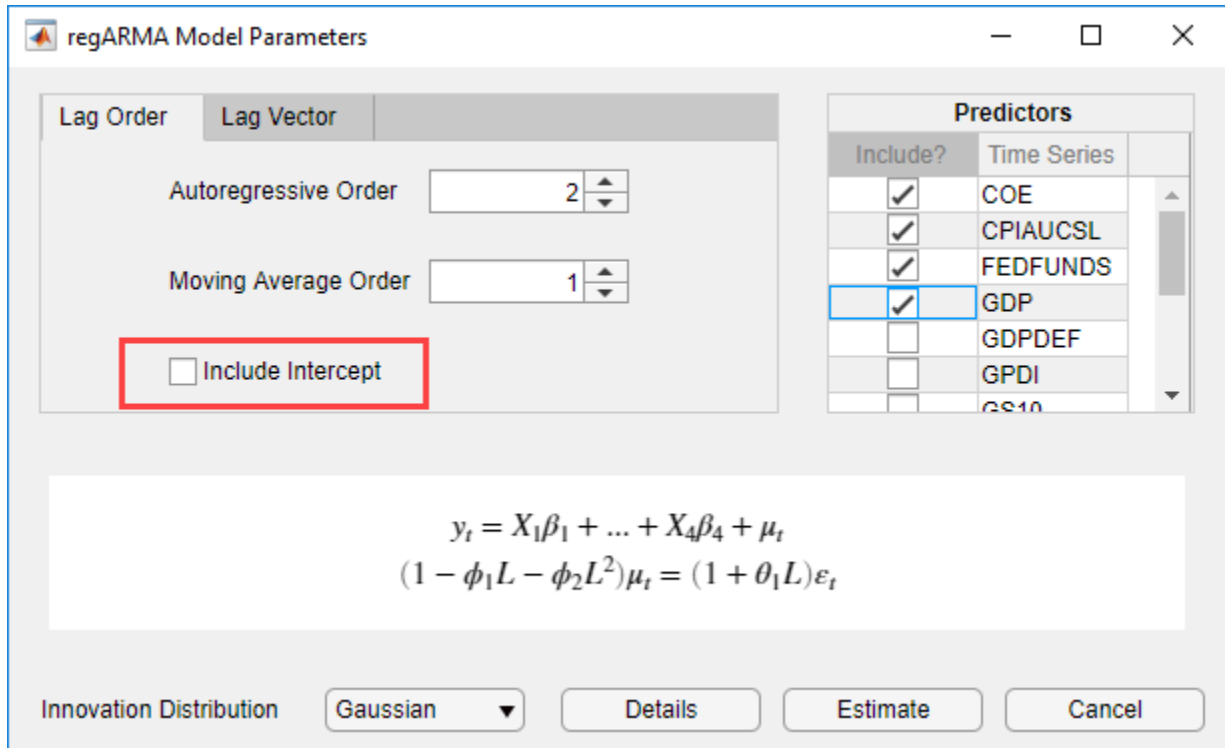
---

After creating a Bayesian linear regression model object using `bayeslm`, you can combine the prior model with data to form the posterior distribution and perform variable selection. The disturbances are iid Gaussian random variables with a mean of 0 and a constant variance. Variable selection, posterior distribution estimation, and analysis functions include:

- `estimate` — Perform variable selection and estimate posterior distribution characteristics given predictor and response data.
- `simulate` — Simulate posterior distribution values for Monte Carlo estimation.
- `forecast` — Forecast responses given new predictor data with respect to the posterior predictive distribution.

### **Econometric Modeler App: Exclude intercept from linear models or regression models with ARMA errors**

In the **Econometric Modeler** app, when you specify a multiple linear regression model or regression model with ARMA errors for estimation, you can exclude an intercept from the model by clearing the **Include Intercept** check box.



## Bayesian Linear Regression: Access covariance estimates from estimation summary tables

The estimation summary table, returned by `estimate` and `summarize` as a MATLAB<sup>®</sup> table, stores the estimated covariance of the regression coefficient and disturbance variance estimates in the `Covariances` variable.

## armairf Function: Supply or return graphics object handles

The `armairf` function accepts a vector of axes handles in which to plot and returns handles to plotted graphics objects.

For details on graphics objects, see [Graphics Objects](#).



---

## Functionality being removed or changed

### **armairf returns separate figures for each variable in the system**

#### *Behavior change*

The `armairf` function now plots, in separate figures, the impulse response function (IRF) of the `numVars` variables in a system. Each figure contains `numVars` line plots representing the responses of a variable to a shock to all variables in the system at time 0.

In previous releases, `armairf` returned one figure containing separate subplots for each variable.

### **armairf permutes the second and third dimensions of the impulse response array output**

#### *Behavior change*

When you estimate and return a multivariate impulse response function (IRF) by using `armairf`:

- The `numVars` columns of the 3-D array output now correspond to the `numVars` variables in the system receiving a shock at time 0.
- The `numVars` pages of the 3-D array output now correspond to the IRF of the `numVars` variables in the system.

In other words, element  $t,j,k$  of the returned 3-D array is the IRF of variable  $k$  to a shock to variable  $j$  at time 0, for  $t = 1, \dots, \text{numObs}$ . `numObs` is the number of observations in the IRF representing times  $0, \dots, \text{numObs} - 1$ , respectively, and  $j, k = 1, \dots, \text{numVars}$ .

In previous releases, the `numVars` columns of the 3-D array output of `armairf` corresponded to the IRF of the `numVars` variables in the system, and pages corresponded to the `numVar` variables in the system receiving a shock at time 0.

If you index the columns or pages of the 3-D array output, and you want to update your code so that you obtain results in the same format, permute the column and page indices. For example, suppose `Y` is the IRF returned by `armairf` in R2018b or a later release. To reproduce the formatted results in previous releases, rearrange the columns and pages of `Y` by using `permute`:

```
permute(Y, [1 3 2])
```

**estimate will return only an estimated model object and estimation summary***Warns*

For a simpler interface, the `estimate` function of Bayesian linear regression models will return only an estimated model and an estimation summary table in a future release. That is, `estimate` will return only these output arguments:

```
[PosteriorMdl,Summary] = estimate(...);
```

You will be able to obtain estimated posterior means and covariances, based on the marginal or conditional distributions, from the estimation summary table.

In the current and past releases, `estimate` returns these output arguments:

```
[PosteriorMdl,estBeta,EstBetaCov,estSigma2,estSigma2Var,Summary] = estimate(...);
```

Starting in this release, if you request any output argument other than `PosteriorMdl`, then `estimate` issues this warning:

```
Warning: Current syntax supports 6 output arguments, and will be removed in a future release. For more information on the new syntax, see estimate.
```

For details on how to update your code to prepare for this change, see “Replacing Discouraged Syntaxes of `estimate`”.

# R2018a

---

**Version: 5.0**

**New Features**

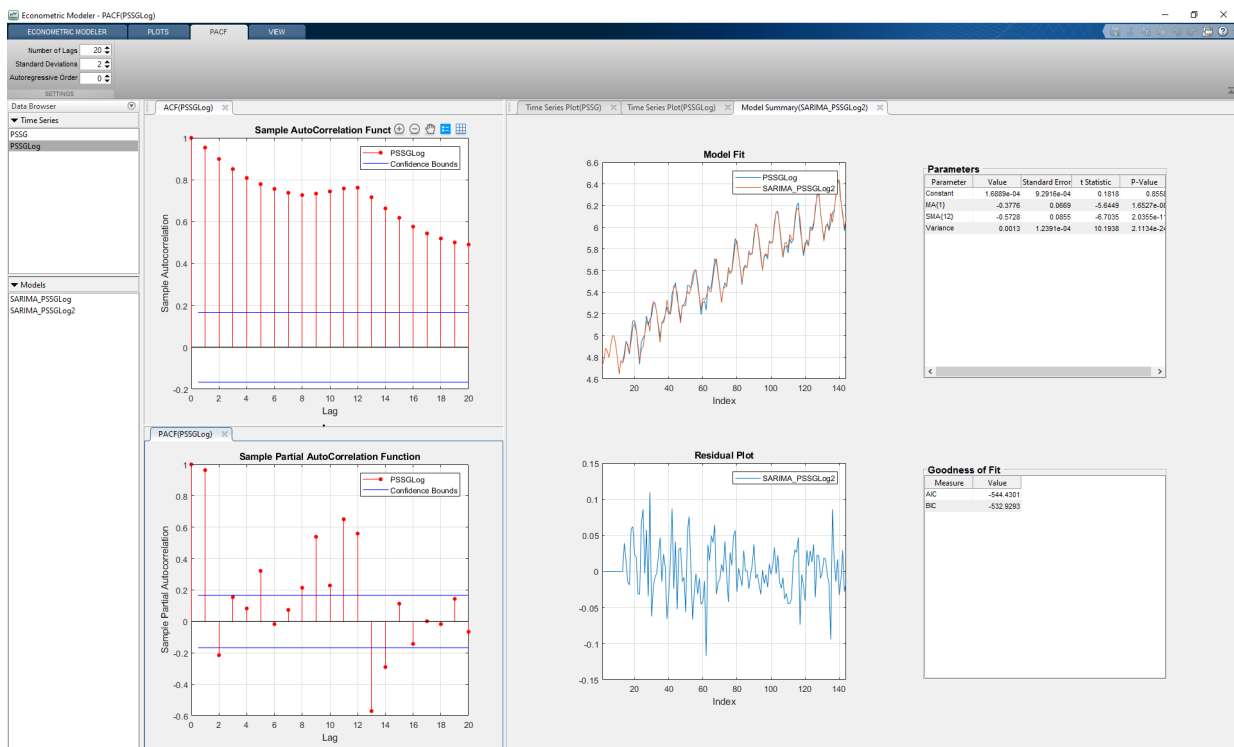
**Compatibility Considerations**

## Econometric Modeler App: Perform time series analysis, specification testing, modeling, and diagnostics

The **Econometric Modeler** app lets you visualize and transform time series data, perform statistical specification and model identification tests, estimate candidate models, and perform post-fit assessments. After working in the app, you can export variables to the MATLAB Workspace and generate code or a report summarizing your session.

To launch the Econometric Modeler app, click the **Apps** tab, then click the app in the **Computational Finance** category of the apps gallery. Or, enter `econometricModeler` at the command line.

For more details, see [Econometric Modeler Overview](#).



---

## **Missing Data Support: Autocorrelation, partial autocorrelation, and Ljung-Box Q-test calculations account for missing observations**

The `autocorr`, `parcorr`, and `lbqtest` functions treat NaN values in the data as missing completely at random.

## **Toolbox Plotting Functions: Supply or return graphics object handles**

These functions accept a graphics handle in which to plot and return handles to plotted graphics objects.

- `autocorr`
- `distplot`
- `collintest`
- `corrplot`
- `crosscorr`
- `cusumtest`
- `eigplot`
- `fgls`
- `graphplot`
- `parcorr`
- `recreg`
- `simplot`

For details on graphics objects, see Graphics Objects.

## **Model Summary: Display estimation results from fitting models**

The `arma`, `regARIMA`, `garch`, `egarch`, and `gjr` model objects allow you to display estimation results from estimated models by using the `summarize` function. Estimation results include parameter estimates, standard errors,  $t$  statistics,  $p$ -values, and model fit

statistics. For more details, see `summarize` for arima models, `summarize` for regARIMA models, and `summarize` for conditional variance models.

## **Model Description: Assign descriptions to econometric model objects**

The `arima`, `regARIMA`, `garch`, `egarch`, and `gjr` model objects allow you to assign a description to the model by setting the `Description` property.

## **Model Lag Parameters: Use indices that are consistent with MATLAB cell array indexing**

The indices of cell arrays of lag operator polynomial coefficients for `arima`, `regARIMA`, `garch`, `egarch`, and `gjr` model objects follow MATLAB cell array indexing rules.

Affected model properties are:

- AR, MA, SAR, and SMA properties of `arima` and `regARIMA` models
- GARCH and ARCH properties of `garch`, `egarch`, and `gjr` models
- Leverage property of `egarch` and `gjr` models

## **Compatibility Considerations**

- You cannot access any lag-zero coefficients by using an index of 0. For example, `Mdl.AR{0}` issues an error, where `Mdl` is an `arima` model.

Remove any instances of such indices of zero from your code. The value of all lag-zero coefficients is 1 except for lag operator polynomials corresponding to the ARCH and Leverage properties, which have the value 0.

- You cannot index beyond the maximal lag in the polynomial. For example, if `Mdl.P` is 4, then `Mdl.AR{p}` issues an error when `p` is greater than 4. For details on the maximal lags of the lag operator polynomials, see the corresponding property descriptions in the reference pages.

Remove any instances of such indices beyond the maximal lag from your code. All coefficients beyond the maximal lag are 0.

---

## Model Distribution: Store innovation distribution name as string scalar

In `arima`, `regARIMA`, `garch`, `egarch`, and `gjr` model objects, the `Name` field of the `Distribution` property stores the innovation distribution name as a string scalar, for example, "Gaussian".

## Compatibility Considerations

Previously, MATLAB stored the innovation distribution name as a character vector, for example 'Gaussian'. Although most text-data operations accept character vectors and string scalars for text-data input, there are some differences between the two data types. For more details, see [Characters and Strings](#).

## Functionality Being Removed or Changed

Functionality	Result	Use Instead	Compatibility Considerations
<code>autocorr(y,numLags)</code> <code>autocorr(y,numLags,numMA)</code> <code>autocorr(y,numLags,numMA,numSTD)</code>	Still runs	Name-value pair argument syntax, for example, <code>autocorr(y,'NumLags',numLags)</code>	Replace all instances of <code>numLags</code> , <code>numMA</code> , and <code>numSTD</code> with corresponding name-value pair argument syntax.
<code>crosscorr(y1,y2,numLags)</code> <code>crosscorr(y1,y2,numLags,numSTD)</code>	Still runs	Name-value pair argument syntax, for example, <code>crosscorr(y1,y2,'NumLags',numLags)</code>	Replace all instances of <code>numLags</code> and <code>numSTD</code> with corresponding name-value pair argument syntax.

Functionality	Result	Use Instead	Compatibility Considerations
<code>parcorr(y,numLags)</code> <code>parcorr(y,numLags,numAR)</code> <code>parcorr(y,numLags,numAR,numSTD)</code>	Still runs	Name-value pair argument syntax, for example, <code>parcorr(y,'NumLags',numLags)</code>	Replace all instances of <code>numLags</code> , <code>numAR</code> , and <code>numSTD</code> with corresponding name-value pair argument syntax.
<code>print</code> function for <code>arma</code> , <code>regARIMA</code> , <code>garch</code> , <code>egarch</code> , and <code>gjr</code> model objects	Warns	<code>summarize</code> for <code>arma</code> models <code>summarize</code> for <code>regARIMA</code> models <code>summarize</code> for conditional variance models	Replace all instances of <code>print</code> with <code>summarize</code> .
<code>archtest(residuals,lags)</code> <code>archtest(residuals,lags,alpha)</code>	Issues error	Name-value pair argument syntax, for example, <code>archtest(residuals,'Lags',lags)</code>	Replace all positional argument usages of <code>lags</code> and <code>alpha</code> with corresponding name-value pair argument syntax.
<code>lbqtest(series,lags)</code> <code>lbqtest(series,lags,alpha)</code> <code>lbqtest(series,lags,alpha,dof)</code>	Issues error	Name-value pair argument syntax, for example, <code>lbqtest(series,'Lags',lags)</code>	Replace all positional argument usages of <code>lags</code> , <code>alpha</code> , and <code>dof</code> with corresponding name-value pair argument syntax.
<code>vgxar</code>	Issues error	<code>arma2ar</code>	Replace all instances of <code>vgxar</code> with <code>arma2ar</code> .



<b>Functionality</b>	<b>Result</b>	<b>Use Instead</b>	<b>Compatibility Considerations</b>
vgxcount	Issues error	summarize function of the varm object	Replace all instances of vgxcount with summarize.
vgxdisp	Issues error	summarize function of the varm object	Replace all instances of vgxdisp with summarize.
vgxget	Issues error	Dot notation on the varm model object	Replace all instances of vgxget with dot notation on the varm model object.
vgxinfer	Issues error	infer function of the varm object	Replace all instances of vgxinfer with infer.
vgxloglik	Issues error	infer function of the varm object	Replace all instances of vgxloglik with infer.
vgxma	Issues error	arma2ma	Replace all instances of vgxma with arma2ma.
vgxplot	Issues error	subplot and plot	Replace all instances of vgxplot with subplot and plot.
vgxpred	Issues error	forecast function of the varm object	Replace all instances of vgxpred with forecast.

<b>Functionality</b>	<b>Result</b>	<b>Use Instead</b>	<b>Compatibility Considerations</b>
vgxproc	Issues error	filter function of the varm object	Replace all instances of vgxproc with filter.
vgxqual	Issues error	isStable function of the LagOp object	Replace all instances of vgxqual with isStable.
vgxset	Issues error	varm	Replace all instances of vgxset with varm or use dot notation.
vgxsim	Issues error	simulate function of the varm object	Replace all instances of vgxsim with simulate.
vgxvarx	Issues error	estimate function of the varm object	Replace all instances of vgxvarx with estimate.
'print' name-value pair argument of the estimate function for arima, garch, egarch, and gjr model objects	Issues error	'Display' name-value pair argument	Replace all instances of 'print', true with 'Display', 'on', and 'print', false with 'Display', 'off'.
Data_VARMA22 data set	Issues error	N/A	Remove all instances from your code.

# R2017b

---

**Version: 4.1**

**New Features**

## **Discrete-Time Markov Chains: Analyze the structure and evolution of Markov models**

Econometrics Toolbox has a class of tools for analyzing the structure and evolution of discrete-time Markov chains. The `dtmc` function creates model objects from empirical transition counts or theoretical transition probabilities. The `mcmix` function creates random models with a specified structure for testing purposes. The tools support state classification and the analysis of asymptotic behavior. A variety of visualization methods complement the analytic tools.

## **Vector Error-Correction Model: Analyze multivariate time series with cointegrating relationships**

Econometrics Toolbox has a vector error-correction (VEC) model for multivariate time series with cointegrating relationships. The `vecm` function creates model objects characterizing VEC models with cointegration. Additional functions support modeling workflows for estimation, simulation, and forecasting.

In addition to the VEC model analysis tools, you can convert a VAR model (a `varm` model object) to its equivalent VEC model representation using `vecm`.

## **Bayesian Linear Regression: Draw samples from posterior distributions using the Hamiltonian Monte Carlo sampler**

Bayesian linear regression models with custom prior distributions (that is, `customblm` model objects) can efficiently draw from corresponding parameter posterior distributions using the Hamiltonian Monte Carlo sampler. For more details, see *Using Hamiltonian Monte Carlo* (Statistics and Machine Learning Toolbox™).

## **New Data Set**

Econometrics Toolbox includes a new data set containing quarterly U.S. macroeconomic measurements from 1957:Q1-2016:Q4 and quarterly econometric projections for the following 10 years from the Congressional Budget Office.

To load the data set, enter the following code at the command line.

```
load Data_USEconVECMoDel
```

# R2017a

---

**Version: 4.0**

**New Features**

**Compatibility Considerations**

## Bayesian Linear Regression: Analyze posterior distributions of random parameters in multiple regression models

Econometrics Toolbox has a Bayesian linear regression model for analyzing the linear relationship between a response and a set of predictor variables. The `bayeslm` function creates a Bayesian linear regression model object that characterizes the joint prior distribution on the regression coefficients and disturbance variance. This table lists supported prior models, ordered by increasing flexibility and complexity.

Model object	Description
<code>conjugateblm</code>	<ul style="list-style-type: none"> <li>Conjugate normal-inverse-gamma model</li> <li>The regression coefficients and the disturbance variance are dependent</li> </ul>
<code>semiconjugateblm</code>	<ul style="list-style-type: none"> <li>Semiconjugate normal-inverse-gamma model</li> <li>The regression coefficients and disturbance variance are independent</li> </ul>
<code>diffuseblm</code>	<ul style="list-style-type: none"> <li>Diffuse model</li> <li>The joint prior distribution is inversely proportional to the disturbance variance</li> </ul>
<code>empiricalblm</code>	<ul style="list-style-type: none"> <li>Empirical model</li> <li>You supply draws from the joint distribution, which characterizes the joint prior</li> </ul>
<code>customblm</code>	<ul style="list-style-type: none"> <li>Custom model</li> <li>The log of the joint prior distribution is described in a declared function.</li> </ul>

After creating a Bayesian linear regression model object using `bayeslm`, you can combine the prior model with data to form and analyze the posterior distribution. The data likelihood is always formed by assuming that the disturbances are I.I.D. Gaussian random variables with a mean of 0 and a constant variance. Posterior distribution formation and analysis functions include:

- Estimation of posterior distribution characteristics given predictor and response data using `estimate`
- Simulation of posterior distribution values for Monte Carlo estimation using `simulate`

- Forecasting responses for new predictor data with respect to the posterior predictive distribution using `forecast`

## Vector Autoregressive Model: Analyze multivariate time series data including exogenous predictors

Econometrics Toolbox has a vector autoregressive model including exogenous predictor data (VARX) for analyzing multivariate time series data. The `varm` function creates a `varm` model object, which characterizes a VARX( $p$ ) model. After creating a `varm` model object, you can:

- Fit the model to predictor and response data using `estimate`.
- Simulate observations given predictor data using `simulate`.
- Forecast observations given new predictor data using `forecast`.

## Functionality Being Removed or Changed

Functionality	Result	Use Instead	Compatibility Considerations
<code>vgxar</code>	Warns	<code>arma2ar</code>	Replace all instances of <code>vgxar</code> with <code>arma2ar</code> .
<code>vgxcount</code>	Warns	<code>summarize</code> function of the <code>varm</code> object	Replace all instances of <code>vgxcount</code> with <code>summarize</code> .
<code>vgxdisp</code>	Warns	<code>summarize</code> function of the <code>varm</code> object	Replace all instances of <code>vgxdisp</code> with <code>summarize</code> .

<b>Functionality</b>	<b>Result</b>	<b>Use Instead</b>	<b>Compatibility Considerations</b>
vgxget	Warns	Dot notation on varm model object	Replace all instances of <code>vgxget</code> with dot notation on varm model object.
vgxinfer	Warns	<code>infer</code> function of the varm object	Replace all instances of <code>vgxinfer</code> with <code>infer</code> .
vgxloglik	Warns	<code>infer</code> function of the varm object	Replace all instances of <code>vgxloglik</code> with <code>infer</code> .
vgxma	Warns	<code>arma2ma</code>	Replace all instances of <code>vgxma</code> with <code>arma2ma</code> .
vgxplot	Warns	<code>subplot</code> and <code>plot</code>	Replace all instances of <code>vgxplot</code> with <code>subplot</code> and <code>plot</code> .
vgxpred	Warns	<code>forecast</code> function of the varm object	Replace all instances of <code>vgxpred</code> with <code>forecast</code> .
vgxproc	Warns	<code>filter</code> function of the varm object	Replace all instances of <code>vgxproc</code> with <code>filter</code> .



<b>Functionality</b>	<b>Result</b>	<b>Use Instead</b>	<b>Compatibility Considerations</b>
vgxqual	Warns	isStable function of the LagOp object.	Replace all instances of vgxqual with isStable.
vgxset	Warns	varm	Replace all instances of vgxset with varm or use dot notation.
vgxsim	Warns	simulate function of the varm object	Replace all instances of vgxsim with simulate.
vgxvarx	Warns	estimate function of the varm object	Replace all instances of vgxvarx with estimate.



# R2016b

---

**Version: 3.5**

**Bug Fixes**

**Compatibility Considerations**

## **Econometrics data folder renamed to econdata**

The `econdemos` folder in `matlabroot/toolbox/econ` is now named `econdata`.

## **Compatibility Considerations**

To avoid errors, replace all instances of `econdemos` in your code with `econdata`.

# R2016a

---

**Version: 3.4**

**New Features**

**Compatibility Considerations**

## Cusum Structural Change Tests: Assess stability of multiple linear regression models

The `cusumtest` function implements the Brown-Durbin-Evans cusum test to assess the stability of coefficients over time in multiple linear regression models. `cusumtest` supports:

- Both cusum and cusum of squares tests
- Estimating recursive residuals using forward and backward regressions
- Plotting recursive residuals with critical lines

## Recursive Linear Regression: Recursively estimate coefficients of multiple linear regression models

The `recreg` function plots estimated, multiple linear regression model coefficients from recursive linear regressions to examine the stability of the coefficients over time. `recreg` supports:

- Nested or rolling-window subsamples of the data
- Estimating coefficients and standard errors using ordinary-least-squares (OLS) or robust methods (HAC and FGLS)

## Functionality being removed

Function Name	What Happens When You Use This Function?	Use This Function Instead	Compatibility Considerations
<code>vartovec</code>	Errors	<code>var2vec</code>	Replace all existing instances of <code>vartovec</code> with the correct <code>var2vec</code> syntax.

---

<b>Function Name</b>	<b>What Happens When You Use This Function?</b>	<b>Use This Function Instead</b>	<b>Compatibility Considerations</b>
vectovar	Errors	vec2var	Replace all existing instances of <code>vectovar</code> with the correct <code>vec2var</code> syntax.





# R2015b

---

**Version: 3.3**

**New Features**

**Compatibility Considerations**

## **Model Conversion Functions: Convert between VEC models and VAR models**

Given known coefficient matrices of the first difference terms in a VEC model, the `vec2var` function returns the autoregressive coefficient matrices of the equivalent VAR model representation.

Given known, autoregressive coefficient matrices of a VAR model, the `var2vec` function returns the coefficient matrices of the first difference and error correction terms of the equivalent VEC model representation.

## **Diffuse Kalman Filter: Model state-space systems having diffuse initial state distributions**

The `ds sm` model object applies the diffuse Kalman filter to obtain exact filtered and smoothed states in the presence of states having infinite initial distribution variance.

Specify a diffuse state-space model using `ds sm`, identify the diffuse states, and then:

- Estimate its parameters using `estimate`.
- Implement forward recursion of the state-space model using `filter`.
- Implement backward recursion of the state-space model using `smooth`.
- Forecast states and observations using `forecast`.

## **Chow Structural Change Test: Assess stability of multiple linear regression models**

The `chowtest` function implements a variety of Chow tests to assess the stability of coefficients over time in multiple linear regression models. The framework supports both “breakpoint” and “forecast” tests, and the testing of specific coefficient subsets.

## **ARMAIRF Function: Calculate impulse responses for ARMA models**

The `armairf` function filters innovation shocks through each variable in a multivariate autoregressive, moving average model, and returns the response as a numeric array or a impulse response plot.

---

## New Data Set

Econometrics Toolbox includes a new data set containing U.S. food consumption statistics, 1927–1962. Load the data set using `load Data_Consumption`. The reference that analyzes the data is Maddala, G. S. *Introduction to Econometrics*. 2nd Ed., New York, NY: Macmillan, 1992.

## Functionality being removed

Function Name	What Happens When You Use This Function?	Use This Function Instead	Compatibility Considerations
<code>garchar</code>	Errors	<code>arma2ar</code>	Replace all existing instances of <code>garchar</code> with the correct <code>arma2ar</code> syntax.
<code>garchma</code>	Errors	<code>arma2ma</code>	Replace all existing instances of <code>garchma</code> with the correct <code>arma2ma</code> syntax.
<code>vartovec</code>	Warns	<code>var2vec</code>	Replace all existing instances of <code>vartovec</code> with the correct <code>var2vec</code> syntax.

<b>Function Name</b>	<b>What Happens When You Use This Function?</b>	<b>Use This Function Instead</b>	<b>Compatibility Considerations</b>
vectovar	Warns	vec2var	Replace all existing instances of <code>vectovar</code> with the correct <code>vec2var</code> syntax.

# R2015a

---

**Version: 3.2**

**New Features**

**Compatibility Considerations**

## State-space example for Diebold-Li model

The example analyzes yield curves derived from government bond data using the popular Diebold-Li yields-only model in the state-space model framework: Using the Kalman Filter to Estimate and Forecast the Diebold-Li Model.

## Autoregressive moving average (ARMA) to AR and MA conversions

Given coefficient values for lagged terms of an ARMA model, the `arma2ar` function returns the coefficients of the truncated AR model, and `arma2ma` function returns the coefficients of the truncated MA model.

## Functionality being removed

Function Name	What Happens When You Use This Function?	Use This Function Instead	Compatibility Considerations
<code>garchar</code>	Warns	<code>arma2ar</code>	Replace all existing instances of <code>garchar</code> with the correct <code>arma2ar</code> syntax.
<code>garchma</code>	Warns	<code>arma2ma</code>	Replace all existing instances of <code>garchma</code> with the correct <code>arma2ma</code> syntax.

# R2014b

---

**Version: 3.1**

**New Features**

**Compatibility Considerations**

## Simulation smoothing for state-space models

The `ssm` model object has the method `simsmooth` for sampling from the posterior distribution of the states using forward filtering, backward sampling.

## Feasible generalized least squares (FGLS) estimators

The `fgls` function uses generalized least squares (GLS) to estimate coefficients and standard errors in multiple linear regression models with nonspherical errors by first estimating the covariance of the innovations process.

## Time-series regression example

The example, following a series of time series regression examples, illustrates how to estimate multiple linear regression models of time series data in the presence of heteroscedastic or autocorrelated (nonspherical) innovations: Time Series Regression X: Generalized Least Squares and HAC Estimators.

## Shipped data sets now support tabular arrays

Econometrics Toolbox data sets organize data in tabular arrays rather than `dataset` arrays.

## Compatibility Considerations

To access or modify a tabular array, you must use `table` indexing and functions. For details, see [Tables](#).

## Functions now support tabular arrays

`hac`, `il0test`, `corrplot`, and `collintest` accept tabular arrays as input arguments. `jcitest` returns tabular arrays.

## Compatibility Considerations

To access or modify the output tables of `jcitest`, you must use `table` indexing and functions. For details, see [Tables](#).



# R2014a

---

**Version: 3.0**

**New Features**

**Compatibility Considerations**

## **Time-invariant and time-varying, linear, Gaussian state-space models**

Econometrics Toolbox has a model for performing univariate and multivariate time-series data analysis.

- The `ssm` model supports time-invariant and time-varying, linear state-space models.
- Specify a state-space model using `ssm`, and then:
  - Estimate its parameters using `estimate`.
  - Implement forward recursion of the state-space model using `filter`.
  - Implement backward recursion of the state-space model using `smooth`.
  - Simulate states and observations using `simulate`.
  - Forecast states and observations using `forecast`.

## **Kalman filter with missing data**

The methods of the state-space model, `ssm`, use the Kalman filter to estimate the states, and also use this framework to manage missing data.

## **Performance enhancements for ARIMA and GARCH models**

The `estimate` methods of the `arima`, `egarch`, `garch`, `gjr`, and `regARIMA` models have been enhanced to converge more quickly, and, therefore, you might experience faster estimation durations.

## **SDE functions moved from Econometrics Toolbox to Financial Toolbox**

The following stochastic differential equation (SDE) functions have moved from Econometrics Toolbox to Financial Toolbox™:

- `bm`
- `cev`
- `cir`
- `diffusion`

- 
- drift
  - gbm
  - heston
  - hww
  - interpolate
  - sde
  - sdeddo
  - sdemrd
  - simByEuler
  - simBySolution
  - simulate
  - cev
  - ts2func

## **Data set and example functions moved from Econometrics Toolbox to Financial Toolbox**

The following data set and example functions from the matlab/toolbox/econ/econdemos folder have moved to matlab/toolbox/finance/findemos:

- Demo\_AmericanBasket
- Example\_BarrierOption
- Example\_BlackScholes
- Example\_CEVModel
- Example\_CIRModel
- Example\_CopulaRNG
- Example\_LongstaffSchwartz
- Example\_StratifiedRNG
- Data\_GlobalIdx2.mat

## Functionality being removed

Function Name	What Happens When You Use This Function?	Use This Function Instead	Compatibility Considerations
<code>garchcount</code>	Errors	<code>sum(any(EstParamCov))</code> , where <code>EstParamCov</code> is an estimated parameter covariance matrix of a fitted <code>arma</code> , <code>garch</code> , <code>egarch</code> , or <code>gjr</code> model	N/A
<code>garchdisp</code>	Errors	<code>print</code> method of the classes	Replace all existing instances of <code>garchdisp</code> with the correct <code>print</code> syntax.
<code>garchfit</code>	Errors	<code>estimate</code> method of the classes <code>arma</code> , <code>garch</code> , <code>egarch</code> , or <code>gjr</code>	Replace all existing instances of <code>garchfit</code> with the correct <code>estimate</code> syntax.
<code>garchget</code>	Errors	<code>arma</code> , <code>garch</code> , <code>egarch</code> , or <code>gjr</code>	Specify a model using the appropriate model creator <code>arma</code> , <code>garch</code> , <code>egarch</code> , or <code>gjr</code> . Use Dot Notation to retrieve parameter values from the model.

<b>Function Name</b>	<b>What Happens When You Use This Function?</b>	<b>Use This Function Instead</b>	<b>Compatibility Considerations</b>
garchinfer	Errors	infer method of the classes arima, garch, egarch, or gjr	Replace all existing instances of garchinfer with the correct infer syntax.
garchplot	Errors	N/A	N/A
garchpred	Errors	forecast method of the classes arima, garch, egarch, or gjr	Replace all existing instances of garchpred with the correct forecast syntax.
garchset	Errors	arima, garch, egarch, or gjr	Specify a model using the appropriate model creator arima, garch, egarch, or gjr. Use Dot Notation to set parameter values for the model.

<b>Function Name</b>	<b>What Happens When You Use This Function?</b>	<b>Use This Function Instead</b>	<b>Compatibility Considerations</b>
garchsim	Errors	simulate method of the classes arima, garch, egarch, or gjr	Replace all existing instances of garchsim with the correct simulate syntax.

# R2013b

---

**Version: 2.4**

**New Features**

**Compatibility Considerations**

## Regression models with ARIMA errors

Econometrics Toolbox has a new model for performing time series regression analysis.

- The `regARIMA` model supports linear regression models with ARIMA error processes, including AR, MA, ARMA, and seasonal error models.
- Specify a regression model with ARIMA errors using `regARIMA`, then
  - Estimate its parameters using the data and `estimate`.
  - Simulate responses using `simulate`.
  - Forecast responses using `forecast`.
  - Infer residuals using `infer`.
  - Filter innovations using `filter`.
  - Plot an impulse response using `impulse`.
  - Convert it to an ARIMA model using `arima`.

## Time series regression example for lag order selection

The example, following a series of time series regression examples, illustrates predictor history selection for multiple linear regression models: Time Series Regression IX: Lag Order Selection.

## optimoptions support

`optimoptions` support when using solver optimization options to:

- Estimate `arima` models using `estimate`.
- Estimate `garch` models using `estimate`.
- Estimate `egarch` models using `estimate`.
- Estimate `gjr` models using `estimate`.

## Compatibility Considerations

When estimating `arima`, `garch`, `egarch`, or `gjr` models using `estimate`, the default solver options now reference an `optimoptions` object, instead of an `optimset` structure. If you now use default solver options and operate on them assuming this is an `optimset` structure, some operations might not work.



---

`optioptions` is the default and recommended method to set solver options, though `optimset` is also supported.

## Estimation display options

The options for the Command Window display of `arima/estimate`, `garch/estimate`, `egarch/estimate`, and `gjr/estimate` is simplified and enhanced. You can easily:

- Display only the maximum likelihood parameter estimates, standard errors, and  $t$  statistics. This is the new default.
- Display only iterative optimization information.
- Display only optimization diagnostics.
- Display all of the above.
- Turn off all output.

## Compatibility Considerations

The new, recommended name-value pair argument that controls the display is `Display`. However, the software still supports the previous name-value pair argument, `print`.

## Functionality being removed



# R2013a

---

**Version: 2.3**

**New Features**

**Compatibility Considerations**

## **Heteroscedasticity and autocorrelation consistent (HAC) covariance estimators**

The new `hac` function estimates robust covariances for ordinary least squares coefficients of multiple linear regression models under general forms of heteroscedasticity and autocorrelation.

## **Regression component added to ARIMA models**

You can include a regression component to an `arima` model to measure the linear effects that exogenous covariate series have on a response series. This new functionality also enhances `estimate`, `filter`, `forecast`, `infer`, and `simulate`.

## **Compatibility Considerations**

This new `arima` functionality replaces `garchfit`, `garchdisp`, `garchinfer`, `garchget`, `garchset`, `garchpred`, and `garchsim`. Change all instances of those functions using the new `arima` syntax.

## **Changes to `lmctest`**

`lmctest` uses `estimate` rather than `garchfit` to calculate the MLEs under the alternative hypothesis.

## **Compatibility Considerations**

You might receive slightly different estimates and, in some cases, p-values for the same data under the previous functionality of `lmctest`.

## **Functionality being removed**

# R2012b

---

**Version: 2.2**

**New Features**

## **Impulse response (dynamic multipliers) for ARIMA models**

The `arma` model object has a new `impulse` method for generating and plotting impulse response functions for ARIMA models.

## **Filter user-specified disturbances through ARIMA and conditional variance models**

There are new methods to filter user-specified disturbances through ARIMA and conditional variance models:

- `filter` for `arma` model objects to filter disturbances through an ARIMA process.
- `filter` for `garch` model objects to filter disturbances through a GARCH process.
- `filter` for `egarch` model objects to filter disturbances through an EGARCH process.
- `filter` for `gjr` model objects to filter disturbances through a GJR process.

## **A series of new examples on time-series regression techniques**

Eight new examples that illustrate common principles and tasks in time-series regression modeling:

- Time Series Regression I: Linear Models
- Time Series Regression II: Collinearity and Estimator Variance
- Time Series Regression III: Influential Observations
- Time Series Regression IV: Spurious Regression
- Time Series Regression V: Predictor Selection
- Time Series Regression VI: Residual Diagnostics
- Time Series Regression VII: Forecasting
- Time Series Regression VIII: Lagged Variables and OLS Estimator Bias

# R2012a

---

**Version: 2.1**

**New Features**

## New Model Objects and Their Functions

Econometrics Toolbox has four new model objects for modeling univariate time series data.

- The `arma` model object supports ARIMA processes, including AR, MA, ARMA, and seasonal models.
- For modeling conditionally heteroscedastic series, there are new `garch`, `egarch`, and `gjr` model objects, supporting GARCH models and the EGARCH and GJR variants.

Five new functions for each model object simplify the modeling workflow: `estimate`, `infer`, `forecast`, `print`, and `simulate`.

## New Utility Functions

Four new utility functions assist in time series analysis:

- `corrplot` plots predictor correlations.
- `collintest` performs Belsley collinearity diagnostics.
- `il0test` conducts paired integration and stationarity tests.
- `recessionplot` adds recession bands to time series plots.

## Demo for Static Time Series Model Specification

A new demo, “Specifying Static Time Series Models,” steps through the model specification workflow for static multiple linear regression models.

Steps include:

- Detecting multicollinearity
- Identifying influential observations
- Testing for spurious regression due to integrated data
- Selecting predictor subsets using stepwise regression and `lasso`
- Conducting residual diagnostics
- Forecasting

The demo uses many tools from Econometrics Toolbox, and introduces new utility functions useful for model specification.



---

To run the demo in the Command Window, use the command `showdemo Demo_StaticModels`.

## New Data Sets

Econometrics Toolbox includes two new data sets:

- **Data\_CreditDefaults**. Historical data on investment-grade corporate bond defaults and four predictors, 1984–2004. Data are those used in: Loeffler, G., and P. N. Posch. *Credit Risk Modeling Using Excel and VBA*. West Sussex, England: Wiley Finance, 2007.
- **Data\_Recessions**. U.S. recession start and end dates from 1857 to 2011. Source: National Bureau of Economic Research. "U.S. Business Cycle Expansions and Contractions." <http://www.nber.org/cycles.html>.



# R2011b

---

**Version: 2.0.1**

**New Features**

**Compatibility Considerations**

## **Warning and Error ID Changes**

Many warning and error IDs have changed from their previous versions. These warnings or errors typically appear during a function call.

## **Compatibility Considerations**

If you use warning or error IDs, you might need to change the strings you use. For example, if you turned off a warning for a certain ID, the warning might now appear under a different ID. If you use a `try/catch` statement in your code, replace the old identifier with the new identifier. There is no definitive list of the differences, or of the IDs that changed.

# R2011a

---

**Version: 2.0**

**New Features**

## New Cointegration Functionality

Econometrics Toolbox now offers functions for cointegration testing and modeling. The `egcitest` function uses Engle-Granger methods to test for individual cointegrating relationships, and estimates their parameters. The `jcitest` function uses Johansen methods to test for multiple cointegrating relationships, and estimates parameters in corresponding vector error-correction models. The `jcontest` function tests linear restrictions on both error-correction speeds and the space of cointegrating vectors, and estimates restricted model parameters.

## Convert Vector Autoregressive Models to and from Vector Error-Correction Models

The functions `vectovar` and `vartovec` allow you to convert between vector autoregressive (VAR) models and vector error-correction (VEC) models.

## Data Sets for Calibrating Economic Models

Econometrics Toolbox includes three new data sets:

- **Data\_Canada.** Mackinnon's data on inflation and interest rates in Canada, 1954-1994. Data are those used in: MacKinnon, J. G. "Numerical Distribution Functions for Unit Root and Cointegration Tests." *Journal of Applied Econometrics*. v. 11, 1996, pp. 601-618.
- **Data\_JDanish, Data\_JAustralian.** Johansen's data on money and income in Denmark, 1974-1987, and Australia/U.S. purchasing power and interest parity, 1972-1991. Data are those used in: Johansen, *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*. Oxford: Oxford University Press, 1995.

# R2010b

---

**Version: 1.4**

**New Features**

**Compatibility Considerations**

## Functions Being Removed

Function Name	What Happens When You Use This Function?	Use This Function Instead	Compatibility Considerations
<code>dfARDTest</code>	Error	<code>adftest</code>	The new function syntax differs. Replace all existing instances of <code>dfARDTest</code> with the correct <code>adftest</code> syntax.
<code>dfARTest</code>	Error	<code>adftest</code>	The new function syntax differs. Replace all existing instances of <code>dfARTest</code> with the correct <code>adftest</code> syntax.
<code>dftSTest</code>	Error	<code>adftest</code>	The new function syntax differs. Replace all existing instances of <code>dftSTest</code> with the correct <code>adftest</code> syntax.
<code>ppARDTest</code>	Error	<code>pptest</code>	The new function syntax differs. Replace all existing instances of <code>ppARDTest</code> with the correct <code>pptest</code> syntax.
<code>ppARTest</code>	Error	<code>pptest</code>	The new function syntax differs. Replace all existing instances of <code>ppARTest</code> with the correct <code>pptest</code> syntax.
<code>ppTSTest</code>	Error	<code>pptest</code>	The new function syntax differs. Replace all existing instances of <code>ppTSTest</code> with the correct <code>pptest</code> syntax.

## Additional Syntax Options for `archtest` and `lbqtest`

The functions `archtest` and `lbqtest` now take name-value pair arguments as inputs. The old syntax of individual arguments will continue to work but will not be documented.



---

## **New Data Set for Calibrating Economic Models**

The economic data from the paper by Nielsen and Risager, "Stock Returns and Bond Yields in Denmark, 1922-99," (Department of Economics, Copenhagen Business School; Working paper 3-2001, 2001) is now included with Econometrics Toolbox in the file `Data_Danish`.



# R2010a

---

**Version: 1.3**

**New Features**

**Compatibility Considerations**

## Functions Being Removed

Function Name	What Happens When You Use This Function?	Use This Function Instead	Compatibility Considerations
dfARDTest	Error	adftest	The new function syntax differs. Replace all existing instances of dfARDTest with the correct adftest syntax.
dfARTest	Error	adftest	The new function syntax differs. Replace all existing instances of dfARTest with the correct adftest syntax.
dftSTest	Error	adftest	The new function syntax differs. Replace all existing instances of dftSTest with the correct adftest syntax.
ppARDTest	Error	pptest	The new function syntax differs. Replace all existing instances of ppARDTest with the correct pptest syntax.
ppARTest	Error	pptest	The new function syntax differs. Replace all existing instances of ppARTest with the correct pptest syntax.
ppTSTest	Error	pptest	The new function syntax differs. Replace all existing instances of ppTSTest with the correct pptest syntax.

## Demo Showing Multivariate Modeling of the U.S. Economy

A new demo, "Modeling the United States Economy," develops a small macroeconomic model. This model is used to examine the impact of various shocks on the United States economy, particularly around the period of the 2008 fiscal crisis. It uses the multiple time series tools from the Econometrics Toolbox.

---

To run the demo in the command window, use the command `echodemo Demo_USEconModel`.

## Lag Operator Polynomial Objects

The new `LagOp` polynomial class provides methods to create and manipulate lag operator polynomials and filter time series data, as well as methods to perform polynomial algebra including addition, subtraction, multiplication, and division.

## Leybourne-McCabe Test for Stationarity

The new Leybourne-McCabe test function `lmctest` assesses the null hypothesis that a univariate time series  $y$  is a trend-stationary  $AR(p)$  process against the alternative that  $y$  is a nonstationary  $ARIMA(p,1,1)$  process.

## Historical Data Sets for Calibrating Economic Models

The new data set `Data_SchwertMacro` contains original data from G. William Schwert's article "Effects of Model Specification on Tests for Unit Roots in Macroeconomic Data," (*Journal of Monetary Economics*, Vol. 20, 1987, pp. 73–103.). These data are a benchmark for unit root tests. The new data set `Data_SchwertStock` contains indices of U.S. stock prices as published in G. William Schwert's article "Indexes of U.S. Stock Prices from 1802 to 1987," (*The Journal of Business*, Vol. 63, 1990, pp. 399–42.). The new data set `Data_USEconModel` contains the macroeconomic series for the new demo `Demo_USEconModel`.

## New Organization and Naming Standard for Data Sets

Econometrics Toolbox has a new set of naming conventions for data sets. Data set names are prefixed by `Data_`.

For full information on the available data sets, demos, and examples, see `Data Sets`, `Demos`, and `Example Functions` or type `help econ/econdemos` at the command line. For more information on Dataset Array objects, see `dataset` in the Statistics Toolbox™ documentation.

## Compatibility Considerations

Replace any instances of `load Old_Data` with `load` and the new file name.

## New Naming Convention for Demos and Example Functions

All demos and examples in the Econometrics Toolbox have been moved to the folder `econ/econdemos` and renamed according to the following convention:

- Demos are named `Demo_DemoName`
- Examples are named `Example_ExampleName`

## Compatibility Considerations

Replace any instances of example functions with their new names. For full information on the available, demos, and examples, see `Data Sets, Demos, and Example Functions` or type `help econ/econdemos` at the command line.

# R2009b

---

**Version: 1.2**

**New Features**

**Compatibility Considerations**

## Unit Root Tests

There are now four classes of unit root tests. More information on the tests is available in the Unit Root Nonstationarity section of the User's Guide.

### Dickey-Fuller and Phillips-Perron Tests

Dickey-Fuller and Phillips-Perron tests now have single interfaces, with new capabilities for multiple testing. Both `adftest` and `pptest` test a unit root null hypothesis against autoregressive, autoregressive with drift, or trend-stationary alternatives.

### KPSS Test

The new `kpsstest` function tests a null hypothesis of (trend) stationarity against nonstationary unit root alternatives.

### Variance Ratio Test

The new `vratiotest` function tests a null hypothesis of a random walk against alternatives with innovations that are not independent and identically distributed.

## Compatibility Considerations

The `ardtest` function replaces the `dfARDTest`, `dfARTest`, and `dfTSTest` functions. The `pptest` function replaces the `ppARDTest`, `ppARTest`, and `ppTSTest` functions. The new function syntax differs from the functions they replace.

## Financial Toolbox Required

Econometrics Toolbox requires Financial Toolbox as of this version.

## Nelson-Plosser Data

The Nelson and Plosser [50] data set is now available. To access the data, enter `load Data_NelsonPlosser` at the MATLAB command line.



# R2009a

---

**Version: 1.1**

**New Features**

**Compatibility Considerations**

## Hypothesis Tests

There are two new hypothesis tests for model misspecification:

- Lagrange Multiplier tests, `lmtest`
- Wald tests, `waldtest`

Furthermore, the likelihood ratio test, `lratiotest`, has been enhanced to be able to “test up” as well as “test down” when performing multiple model comparisons. It now accepts vectors of model parameters for restricted log likelihoods, for unrestricted log likelihoods, or for both.

There is a new demo about these tests; see “New Demo” on page 20-3.

## Compatibility Considerations

`lratiotest` error messages and message IDs differ from previous versions.

## Structural VAR, VARX, and VARMAX models

Econometrics Toolbox multiple time series functions now include structural multiple time series. Structural models have the general form

$$A_0 Y_t = a + X_t b + \sum_{i=1}^p A_i Y_{t-i} + \sum_{j=1}^q B_j W_{t-j} + B_0 W_t.$$

Previously, Econometrics Toolbox multiple time series functions addressed models of the form

$$Y_t = a + X_t b + \sum_{i=1}^p A_i Y_{t-i} + \sum_{j=1}^q B_j W_{t-j} + W_t.$$

The mathematical difference is the inclusion of  $A_0$  and  $B_0$  matrices. These matrices allow practitioners to specify structural dependencies between variables. For more information, see the Multivariate Time Series Models chapter of the Econometrics Toolbox User's Guide.

---

## **Compatibility Considerations**

Objects created with the Econometrics Toolbox V1.0 `vgxset` function, and saved in MAT files, do not work with Econometrics Toolbox V1.1 functions. Recreate the objects with the Econometrics Toolbox V1.1 `vgxset` function.

## **New Demo**

There is a new demo on hypothesis tests. Run the demo at the MATLAB command line by entering `showdemo classicalTestsDemo`.



# R2008b

---

**Version: 1.0**

**New Features**

## Multivariate VAR, VARX, and VARMA Models

A new suite of functions, listed in the following table, adds support for multivariate VAR, VARX, and VARMA models.

Function	Description
vgxar	Convert VARMA specification into a pure vector autoregressive (VAR) model
vgxcount	Count restricted and unrestricted parameters in VAR or VARX models
vgxdisp	Display VGX model parameters and standard errors in different formats
vgxget	Get multivariate time-series specification parameters
vgxinfer	Infer innovations of a VGX process
vgxloglik	Compute conditional log-likelihoods of VGX process
vgxma	Convert VARMA specification into a pure vector moving average (VMA) model
vgxplot	Plot multivariate time series process
vgxpred	Generate transient response of VGX process during a specified forecast period
vgxproc	Generate a VGX process from an innovations process
vgxqual	Determine if a VGX process is stable and invertible
vgxset	Set or modify multivariate time-series specification parameters
vgxsim	Simulate VGX processes
vgxvarx	Solve VAR or VARX model using maximum likelihood estimation

## Heston Stochastic Volatility Models

The new heston function adds support for Heston stochastic volatility models to the SDE engine.

# R2008a

---

**Version: 2.4**

**New Features**

## **Monte Carlo Simulation of Stochastic Differential Equations**

The GARCH Toolbox™ software now allows you to model dependent financial and economic variables, such as interest rates and equity prices, via Monte Carlo simulation of multivariate diffusion processes. For more information, see Stochastic Differential Equations in the GARCH Toolbox documentation.



# R2007b

---

**Version: 2.3.2**

**New Features**

## Changes to garchsim

The `garchsim` function previously allowed you to specify the `State` argument as either a scalar or a time series matrix of standardized, independent, identically distributed disturbances to drive the output `Innovations` in a time series process. The `State` argument must now be a time series matrix. See the `State` input argument on the `garchsim` reference page for more information.

# R2007a

---

**Version: 2.3.1**

**No New Features or Changes**



# R2006b

---

**Version: 2.3**

**New Features**

## **Data Preprocessing**

A new Hodrick-Prescott filter, `hpfiler`, separates time series into trend and cyclical components

## **Demos**

A new demo uses the `hpfiler` function to reproduce the results in Hodrick and Prescott's original paper on U.S. business cycles

# R2006a

---

**Version: 2.2**

**New Features**

## User's Guide

A new chapter in the *GARCH Toolbox User's Guide* explains how to conduct Dickey-Fuller and Phillips-Perron unit root tests with the new statistical functions in the toolbox.

## Statistical Functions

Version 2.2 of the GARCH Toolbox software has six new functions. All of them support the ability to conduct univariate unit root tests on time series data. Three functions support augmented Dickey-Fuller unit root tests. The remaining three support Phillips-Perron unit root tests.

### Dickey-Fuller Unit Root Tests

Function	Purpose
dfARDTest	Augmented Dickey-Fuller unit root test based on AR model with drift.
dfARTest	Augmented Dickey-Fuller unit root test based on zero drift AR model.
dfTSTest	Augmented Dickey-Fuller unit root test based on trend stationary AR model.

### Phillips-Perron Unit Root Tests

Function	Purpose
ppARDTest	Phillips-Perron unit root test based on AR(1) model with drift.
ppARTest	Phillips-Perron unit root test based on zero drift AR(1) model.
ppTSTest	Phillips-Perron unit root test based on trend stationary AR(1) model.



# R14SP3

---

**Version: 2.1**

**New Features**

**Compatibility Considerations**

## Changes to garchsim

A change introduced in V2.1 of the GARCH Toolbox software concerns user-specified noise processes. The `garchsim` function now allows you to provide a time series matrix of standardized, i.i.d. disturbances to drive the output Innovations in a time series process. In previous versions, you could only provide a state that was used to generate a random noise process. See the `State` input argument on the `garchsim` reference page for more information.

## Compatibility Considerations

**garchsim argument Is renamed.** In V2.1, the `garchsim` argument `Seed` is renamed to `State` for consistency with the MATLAB `rand` and `randn` functions. The name change, in itself, introduces no backward incompatibilities. The following topic explains a related change.

**garchsim defaults to current random number generator state.** In V2.0.1 of the GARCH Toolbox software, the `garchsim` function used the initial random number generator state,  $\theta$ , if you did not specify a value for the `Seed` argument. The `Seed` argument corresponded to the `rand` and `randn` state value.

In V2.1, if you do not specify a value for the `State` (formerly `Seed`) argument, `garchsim` uses the current state of `rand` and `randn`, rather than the initial state. Use the commands `s = rand('state')` and `s = randn('state')` to determine the current state of these random number generators. For more information, see the `rand` and `randn` reference pages.