Financial Derivatives Toolbox Release Notes

Contents

Summary by Version

This table provides quick access to what's new in each version. For clarification, see About Release Notes.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V4.0.1 (R2006a)	No	No	Bug Reports at Web site	Printable Release Notes: PDF V4.0 product documentation
V4.0 (R14SP3)	Yes Details	No	Bug Reports at Web site	No
V3.0 (R14)	Yes Details	No	No bug fixes	No
V2.0 (R12.1)	Yes Details	No	No bug fixes	No
V1.0 (R12)	Yes Details	No	No bug fixes	No

About Release Notes

Use release notes when upgrading to a newer version to learn about new features and changes, and the potential impact on your existing files and practices. Release notes are also beneficial if you use or support multiple versions.

If you are not upgrading from the most recent previous version, review release notes for all interim versions, not just for the version you are installing. For example, when upgrading from V1.0 to V1.2, review the New Features and

Changes, Version Compatibility Considerations, and Bug Reports for V1.1 and V1.2.

New Features and Changes

These include

- New functionality
- Changes to existing functionality
- Changes to system requirements (complete system requirements for the current version are at the MathWorks Web site)
- Any version compatibility considerations associated with each new feature or change

Version Compatibility Considerations

When a new feature or change introduces a known incompatibility with the previous version, its description includes a **Compatibility Considerations** subsection that details the impact. For a list of all new features and changes that have compatibility impact, see the Compatibility Summary for Financial Derivatives Toolbox.

Compatibility issues that become known after the product has been released are added to Bug Reports at the MathWorks Web site. Because bug fixes can sometimes result in incompatibilities, also review fixed bugs in Bug Reports for any compatibility impact.

Fixed Bugs and Known Problems

MathWorks Bug Reports is a user-searchable database of known problems, workarounds, and fixes. The MathWorks updates the Bug Reports database as new problems and resolutions become known, so check it as needed for the latest information.

Access Bug Reports at the MathWorks Web site using your MathWorks Account. If you are not logged in to your MathWorks Account when you link to Bug Reports, you are prompted to log in or create an account. You then can view bug fixes and known problems for R14SP2 and more recent releases.

The Bug Reports database was introduced for R14SP2 and does not include information for prior releases. You can access a list of bug fixes made in prior versions via the links in the summary table.

Related Documentation at Web Site

Printable Release Notes (PDF). You can print release notes from the PDF version, located at the MathWorks Web site. The PDF version does not support links to other documents or to the Web site, such as to Bug Reports. Use the browser-based version of release notes for access to all information.

Product Documentation. At the MathWorks Web site, you can access complete product documentation for the current version and some previous versions, as noted in the summary table.

Version 4.0 (R14SP3) Financial Derivatives Toolbox

This table summarizes new features in Version 4.0 (R14SP3):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	No bug fixes	Printable Release Notes: PDF V4.0 product documentation

New features and changes introduced in this version are

- New Interest Rate Models
- Recombining Trinomial Trees
- Enhancement to the treeviewer Function

New Interest Rate Models

The two new interest rate models that have been introduced with Version 4.0 are

- Hull-White (HW) model

  The Hull-White model incorporates the initial term structure of interest rates and the volatility term structure to build a trinomial recombining tree of short rates. The resulting tree is used to value interest rate dependent securities. The implementation of the HW model in the Financial Derivatives Toolbox is limited to one factor.
- Black-Karasinski (BK) model

  The BK model is a single-factor, log-normal version of the Hull-White model.

Hull-White and Black-Karasinski Functions

The following tables summarize the Black-Karasinski and Hull-White functions by their category of usage.

Price and Sensitivity from Black-Karasinski Trees

`bkprice`	Instrument prices from Black-Karasinski tree
`bksens`	Instrument prices and sensitivities from Black-Karasinski tree
`bktimespec`	Specify time structure for Black-Karasinski tree
`bktree`	Construct Black-Karasinski interest-rate tree
`bkvolspec`	Specify Black-Karasinski interest-rate volatility process

Price and Sensitivity from Hull-White Trees

`hwprice`	Instrument prices from Hull-White tree
`hwsens`	Instrument prices and sensitivities from Hull-White tree
`hwtimespec`	Specify time structure for Hull-White tree
`hwtree`	Construct Hull-White interest-rate tree
`hwvolspec`	Specify Hull-White interest-rate volatility process

Black-Karasinski Utilities

`bondbybk`	Price bond from Black-Karasinski interest-rate tree
`capbybk`	Price cap instrument from Black-Karasinski interest-rate tree
`cfbybk`	Price arbitrary set of cash flows from Black-Karasinski interest-rate tree
`fixedbybk`	Price fixed-rate note from Black-Karasinski interest-rate tree
`floatbybk`	Price floating-rate note from Black-Karasinski interest-rate tree
`floorbybk`	Price floor instrument from Black-Karasinski interest-rate tree

`optbndbybk`	Price bond option from Black-Karasinski interest-rate tree
`swapbybk`	Price swap instrument from Black-Karasinski interest-rate tree

Hull-White Utilities

`bondbyhw`	Price bond from Hull-White interest-rate tree
`capbyhw`	Price cap instrument from Hull-White interest-rate tree
`cfbyhw`	Price arbitrary set of cash flows from Hull-White interest-rate tree
`fixedbyhw`	Price fixed-rate note from Hull-White interest-rate tree
`floatbyhw`	Price floating-rate note from Hull-White interest-rate tree
`floorbyhw`	Price floor instrument from Hull-White interest-rate tree
`optbndbyhw`	Price bond option from Hull-White interest-rate tree
`swapbyhw`	Price swap instrument from HJM interest-rate tree

Tree Manipulation

`cvtree`	Convert inverse discount tree to interest-rate tree
`mktrintree`	Create recombining trinomial tree
`trintreepath`	Extract entries from node of recombining trinomial tree
`trintreeshape`	Retrieve shape of recombining trinomial tree

Recombining Trinomial Trees

The interest-rate or price trees supported in this toolbox can be either *binomial* (two branches per node) or *trinomial* (three branches per node). Typically, binomial trees assume that underlying interest rates or prices can only either increase or decrease at each node. Trinomial trees allow for a more complex movement of rates or prices. With trinomial trees the movement of rates or prices at each node is unrestricted (for example, up-up-up, or unchanged-down-down).

Enhancement to the treeviewer Function

The `treeviewer` function, which provides a graphical display of rates and prices, has been modified to display recombining trinomial trees.

Version 3.0 (R14) Financial Derivatives Toolbox

This table summarizes new features in Version 3.0 (R14):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	No bug fixes	No

New features and changes introduced in this version are

- Support for Equity Derivatives
- Enhancement to the treeviewer Function

Support for Equity Derivatives

Starting with Version 3.0 the Financial Derivatives Toolbox supports two types of recombining tree models to represent the evolution of stock prices: the Cox-Ross-Rubinstein (CRR) model and the Equal Probabilities (EQP) model. The CRR and EQP models are examples of discrete time models. A discrete time model divides time into discrete bits, and prices can be computed at these specific times only.

The CRR model is one of the most common methods used to model the evolution of stock processes. The strength of the CRR model lies in its simplicity. It is a good model when dealing with a large number of tree levels. The CRR model yields the correct expected value for each node of the tree and provides a good approximation for the corresponding local volatility. The approximation becomes better as the number of time steps represented in the tree is increased.

The EQP model is another discrete time model. It has the advantage of building a tree with the exact volatility in each tree node, even with small numbers of time steps. It also provides better results than CRR in some given trading environments, e.g., when stock volatility is low and interest rates are high. However, this additional precision causes increased complexity, which is reflected in the number of calculations required to build a tree.

New Functions in Version 3.0

Price and Sensitivity from Cox-Ross-Rubinstein Trees

`crrprice`	Instrument prices from a CRR tree
`crrsens`	Instrument prices and sensitivities by a CRR tree
`crrtimespec`	Specify time structure for CRR tree
`crrtree`	Construct CRR stock tree

Cox-Ross-Rubinstein Utilities

`asianbycrr`	Price Asian option by a CRR tree
`barrierbycrr`	Price barrier option by a CRR tree
`compoundbycrr`	Price compound option by a CRR tree
`lookbackbycrr`	Price lookback option by a CRR tree
`optstockbycrr`	Price stock option by a CRR tree

Price and Sensitivity from Equal Probabilities Binomial Trees

`eqpprice`	Instrument prices from an EQP binomial tree
`eqpsens`	Instrument prices and sensitivities from an EQP binomial tree
`eqptimespec`	Specify time structure for EQP tree
`eqptree`	Construct EQP stock tree

Equal Probabilities Tree Utilities

`asianbyeqp`	Price Asian option by an EQP tree
`barrierbyeqp`	Price barrier option by an EQP tree
`compoundbyeqp`	Price compound option by an EQP tree
`lookbackbyeqp`	Price lookback option by an EQP tree
`optstockbyeqp`	Price stock option by an EQP tree

Instrument Portfolio Handling

`instasian`	Construct Asian option instrument
`instbarrier`	Construct barrier option instrument
`instcompound`	Construct compound option instrument
`instlookback`	Construct lookback instrument
`instoptstock`	Construct stock option

Enhancement to the treeviewer Function

The `treeviewer` function, which provides a graphical display of rates and prices, has been modified to accept Cox-Ross-Rubenstein (CRR) and Equal Probabilites (EQP) equity trees as input.

Version 2.0 (R12.1) Financial Derivatives Toolbox

This table summarizes new features in Version 2.0 (R12.1):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	No bug fixes	No

New features and changes introduced in this version are

- Black-Derman-Toy Model

Black-Derman-Toy Model

Version 2.0 of the Financial Derivatives Toolbox adds support for the Black-Derman-Toy (BDT) model for pricing interest rate derivatives. In the BDT model all security prices and rates depend on the short rate (annualized one-period interest rate). The model uses long rates and their volatilities to construct a tree of possible future short rates. It then determines the value of interest rate sensitive securities from this tree.

The Black-Derman-Toy model works with a recombining tree. A recombining tree is the opposite of a bushy tree (used with the Heath-Jarrow-Morton (HJM) introduced in Version 1.0). A recombining tree has branches that recombine over time. From any given node, the node reached by taking the path up-down is the same node reached by taking the path down-up.

New Functions in Version 2.0

The following set of functions has been added to the toolbox to support operations with the BDT model. These functions are the counterparts of the HJM functions from Version 1.0.

Price and Sensitivity from Black-Derman-Toy Trees

Function	Purpose
`bdtprice`	Instrument prices by BDT interest-rate tree
`bdtsens`	Instrument prices and sensitivities by BDT interest-rate tree
`bdttimespec`	Specify time structure for BDT interest-rate tree
`bdttree`	Construct BDT interest-rate tree
`bdtvolspec`	BDT volatility process specification

Black-Derman-Toy Utilities

Function	Purpose
`bondbybdt`	Price bond by BDT interest-rate tree
`capbybdt`	Price cap by BDT interest-rate tree
`cfbybdt`	Price arbitrary set of cash flows by BDT interest rate tree
`fixedbybdt`	Price fixed rate note by BDT interest-rate tree
`floatbybdt`	Price floating rate note by BDT interest-rate tree
`floorbybdt`	Price floor instrument by BDT interest-rate tree
`mmktbybdt`	Create money market tree from BDT
`optbndbybdt`	Price bond option by BDT interest-rate tree
`swapbybdt`	Price swap instrument by BDT interest-rate tree

Black-Derman-Toy Recombining Tree Manipulation

Function	Purpose
`mktree`	Create recombining tree
`treepath`	Extract entries from node of recombining tree
`treeshape`	Retrieve shape of recombining tree

Version 1.0 (R12) Financial Derivatives Toolbox

This table summarizes new features in Version 1.0 (R12):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	No bug fixes	No

The Financial Derivatives Toolbox extends the Financial Toolbox in the areas of fixed-income derivatives and of securities contingent upon interest rates. The toolbox provides components for analyzing individual financial derivative instruments and portfolios composed of them. Specifically, it provides the necessary functions for calculating prices and sensitivities, for hedging, and for visualizing results.

New features and changes introduced in this version are

- Heath-Jarrow-Morton Interest Rate Model
- Hedging Functionality
- Financial Instruments Types

Heath-Jarrow-Morton Interest Rate Model

The Financial Derivatives Toolbox computes pricing and sensitivities of interest rate contingent claims based upon sets of zero coupon bonds or the Heath-Jarrow-Morton (HJM) evolution model of the interest rate term structure.

Hedging Functionality

The Financial Derivatives Toolbox also includes hedging functionality, allowing the rebalancing of portfolios to reach target costs or target sensitivities, which may be set to zero for the case of a neutral-sensitivity portfolio. Optionally, the rebalancing process can be self-financing or directed by a set of user-supplied constraints.

Financial Instruments Types

The toolbox provides a set of functions that perform computations upon portfolios containing up to seven types of financial instruments.

Bond. A long-term debt security with preset interest rate and maturity, by which the principal and interests must be paid.

Bond Options. Puts and calls on portfolios of bonds.

Fixed Rate Note. A long-term debt security with preset interest rate and maturity, by which the interests must be paid. The principal may or may not be paid at maturity. In this version of the Financial Derivatives Toolbox, the principal is always paid at maturity.

Floating Rate Note. A security similar to a bond, but in which the note's interest rate is reset periodically, relative to a reference index rate, to reflect fluctuations in market interest rates.

Cap. A contract that includes a guarantee that sets the maximum interest rate to be paid by the holder, based upon an otherwise floating interest rate.

Floor. A contract that includes a guarantee setting the minimum interest rate to be received by the holder, based upon an otherwise floating interest rate.

Swap. A contract between two parties obligating the parties to exchange future cash flows. This version of the Financial Derivatives Toolbox handles only the vanilla swap, which is composed of a floating rate leg and a fixed rate leg.

Compatibility Summary for Financial Derivatives Toolbox

This table summarizes new features and changes that might cause incompatibilities when you upgrade from an earlier version, or when you use files on multiple versions. Details are provided with the description of the new feature or change.

Version (Release)	New Features and Changes with Version Compatibility Impact
Latest Version V4.0 (R14SP3)	None
V3.0 (R14)	None
V2.0 (R12.1)	None
V1.0 (R12)	None