# Financial Derivatives Toolbox™ Release Notes

# Contents

# Summary by Version

This table provides quick access to what's new in each version. For clarification, see "Using Release Notes" on page 1.

| Version (Release) | New Features and Changes | Version Compatibility Considerations | Fixed Bugs and Known Problems | Related Documentation at Web Site |
|---|---|---|---|---|
| **Latest Version V5.2 (R2008a)** | Yes<br>Details | No | Bug Reports<br>Includes fixes | Printable Release Notes: PDF<br><br>Current product documentation |
| V5.1 (R2007b) | Yes<br>Details | No | Bug Reports | No |
| V5.0 (R2007a) | Yes<br>Details | No | Bug Reports | No |
| V4.1 (R2006b) | No | No | Bug Reports | No |
| V4.0.1 (R2006a) | No | No | Bug Reports | No |
| V4.0 (R14SP3) | Yes<br>Details | No | Bug Reports | No |
| V3.0 (R14) | Yes<br>Details | No | No bug fixes | No |

## Using Release Notes

Use release notes when upgrading to a newer version to learn about:

- New features
- Changes
- Potential impact on your existing files and practices

Review the release notes for other MathWorks™ products required for this product (for example, MATLAB® or Simulink®) for enhancements, bugs, and compatibility considerations that also might impact you.

If you are upgrading from a software version other than the most recent one, review the 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 release notes for V1.1 and V1.2.

## What's in the Release Notes

### New Features and Changes

- New functionality
- Changes to existing functionality

### Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility between versions, the **Compatibility Considerations** subsection explains the impact.

Compatibility issues reported after the product is released appear under Bug Reports at the MathWorks Web site. Bug fixes can sometimes result in incompatibilities, so you should also review the fixed bugs in Bug Reports for any compatibility impact.

### Fixed Bugs and Known Problems

The MathWorks offers a user-searchable Bug Reports database so you can view Bug Reports. The development team updates this database at release time and as more information becomes available. This includes provisions for any known workarounds or file replacements. Information is available for bugs existing in or fixed in Release 14SP2 or later. Information is not available for all bugs in earlier releases.

Access Bug Reports using your MathWorks Account.

# Version 5.2 (R2008a) Financial Derivatives Toolbox™ Software

This table summarizes what's new in Version 5.2 (R2008a):

| New Features and Changes | Version Compatibility Considerations | Fixed Bugs and Known Problems | Related Documentation at Web Site |
|---|---|---|---|
| Yes<br>Details below | No | Bug Reports<br>Includes fixes | Printable Release Notes: PDF<br><br>Current product documentation |

New features and changes introduced in this version are:



## Pricing Callable and Puttable Bonds

Supports the following pricing for callable and puttable bonds:

| Function | Purpose |
|---|---|
| `optembndbybdt` | Price bonds with embedded options by a Black-Derman-Toy interest rate tree |
| `optembndbybk` | Price bonds with embedded options by a Black-Karasinski interest-rate tree |
| `optembndbyhjm` | Price bonds with embedded options by an Heath-Jarrow-Morton interest-rate tree |
| `optembndbyhw` | Price bonds with embedded options by a Hull-White interest-rate tree |
| `instoptembnd` | Constructor for the `'Type'`, `'OptEmBond'` instrument bond option |

In addition, the following functions have been modified to support callable and puttable bonds:

- `instadd`
- `bdtprice`
- `hwprice`
- `hjmprice`
- `bkprice`
- `bdtsens`
- `hwsens`
- `hjmsens`
- `bksens`

## Support for Actual/365 (ISDA)

The following functions now support day count conventions for the `basis` argument based on ISDA (International Swap Dealers Association) actual/365:

- `bondbybdt`
- `bondbybk`
- `bondbyhjm`
- `bondbyhw`
- `bondbyzero`
- `capbybdt`
- `capbybk`
- `capbyhjm`
- `capbyhw`
- `cfbybdt`
- `cfbybk`
- `cfbyhjm`

- cfbyhw
- cfbyzero
- date2time
- disc2rate
- fixedbybdt
- fixedbybk
- fixedbyhjm
- fixedbyhw
- fixedbyzero
- floatbybdt
- floatbybk
- floatbyhjm
- floatbyhw
- floatbyzero
- floorbybdt
- floorbybk
- floorbyhjm
- floorbyhw
- instbond
- instcap
- instcf
- instfixed
- instfloat
- instfloor
- instswap
- instswaption
- intenvset

- optbndbybdt
- optbndbybk
- optbndbyhjm
- optbndbyhw
- rate2disc
- swapbybdt
- swapbybk
- swapbyhjm
- swapbyhw
- swapbyzero
- swaptionbybdt
- swaptionbybk
- swaptionbyhjm
- swaptionbyhw
- time2date

# Version 5.1 (R2007b) Financial Derivatives Toolbox™ Software

This table summarizes what's new in Version 5.1 (R2007b):

| New Features and Changes | Version Compatibility Considerations | Fixed Bugs and Known Problems | Related Documentation at Web Site |
|---|---|---|---|
| Yes<br>Details below | No | Bug Reports | No |

New features and changes introduced in this version are:

## ISMA Support for 30/360 Basis as a Variant of 30/360E with Annual Compounding

The following functions now support day count conventions for the `basis` argument to support 30/360 International Securities Market Association (ISMA) convention as a variant of 30/360E with annual compounding:

- `bondbybdt`
- `bondbybk`
- `bondbyhjm`
- `bondbyhw`
- `bondbyzero`
- `capbybdt`
- `capbybk`
- `capbyhjm`
- `capbyhw`
- `cfbybdt`
- `cfbybk`
- `cfbyhjm`

- cfbyhw
- cfbyzero
- date2time
- disc2rate
- fixedbybdt
- fixedbybk
- fixedbyhjm
- fixedbyhw
- fixedbyzero
- floatbybdt
- floatbybk
- floatbyhjm
- floatbyhw
- floatbyzero
- floorbybdt
- floorbybk
- floorbyhjm
- floorbyhw
- instbond
- instcap
- instcf
- instfixed
- instfloat
- instfloor
- instswap
- instswaption
- intenvset

- optbndbybdt
- optbndbybk
- optbndbyhjm
- optbndbyhw
- rate2disc
- swapbybdt
- swapbybk
- swapbyhjm
- swapbyhw
- swapbyzero
- swaptionbybdt
- swaptionbybk
- swaptionbyhjm
- swaptionbyhw
- time2date

# Version 5.0 (R2007a) Financial Derivatives Toolbox™ Software

This table summarizes what's new in Version 5.0 (R2007a):

| New Features and Changes | Version Compatibility Considerations | Fixed Bugs and Known Problems | Related Documentation at Web Site |
|---|---|---|---|
| Yes<br>Details below | No | Bug Reports | No |

New features and changes introduced in this version are:



## Pricing and Sensitivity from the Implied Trinomial Tree Stock Tree

The following table summarizes the functions supported for pricing and sensitivity from implied trinomial trees.

| Function | Purpose |
|---|---|
| `ittprice` | Price instruments by an implied trinomial tree. |
| `ittsens` | Instrument sensitivities and prices by an implied trinomial tree. |
| `itttree` | Build an implied trinomial stock tree. |
| `itttimespec` | Specify time structure for an implied trinomial tree. |
| `stockoptspec` | Specify European stock options structure. |

## Implied Trinomial Tree Utilities

The following table summarizes the functions supported for implied trinomial trees.

| Function | Purpose |
|---|---|
| `optstockbyitt` | Price options on stocks by an implied trinomial tree. |
| `barrierbyitt` | Price barrier options by an implied trinomial tree. |
| `asianbyitt` | Price Asian options by an implied trinomial tree. |
| `lookbackbyitt` | Price lookback option from an implied trinomial tree. |
| `compoundbyitt` | Price compound options by an implied trinomial tree. |

## Enhancement to the treeviewer Function

The `treeviewer` function, which provides a graphical display of rates and prices, has been modified to accept Implied Trinomial Trees (ITTs) as input.

## ISMA Support

The following functions now support the International Securities Market Association (ISMA) convention for the `basis` argument:

- `bondbybdt`
- `bondbybk`
- `bondbyhjm`
- `bondbyhw`
- `bondbyzero`
- `capbybdt`
- `capbybk`
- `capbyhjm`
- `capbyhw`
- `cfbybdt`
- `cfbybk`

- cfbyhjm
- cfbyhw
- cfbyzero
- date2time
- disc2rate
- fixedbybdt
- fixedbybk
- fixedbyhjm
- fixedbyhw
- fixedbyzero
- floatbybdt
- floatbybk
- floatbyhjm
- floatbyhw
- floatbyzero
- floorbybdt
- floorbybk
- floorbyhjm
- floorbyhw
- instbond
- instcap
- instcf
- instfixed
- instfloat
- instfloor
- instswap
- intenvset

- optbndbybdt
- optbndbybk
- optbndbyhjm
- optbndbyhw
- rate2disc
- swapbybdt
- swapbybk
- swapbyhjm
- swapbyhw
- swapbyzero
- time2date

# Version 4.1 (R2006b) Financial Derivatives Toolbox™ Software

This table summarizes what's new in Version 4.1 (R2006b):

| New Features and Changes | Version Compatibility Considerations | Fixed Bugs and Known Problems | Related Documentation at Web Site |
|---|---|---|---|
| No | No | Bug Reports | No |

# Version 4.0.1 (R2006a) Financial Derivatives Toolbox™ Software

This table summarizes what's new in Version 4.0.1 (R2006a):

| New Features and Changes | Version Compatibility Considerations | Fixed Bugs and Known Problems | Related Documentation at Web Site |
|---|---|---|---|
| No | No | Bug Reports | No |

# Version 4.0 (R14SP3) Financial Derivatives Toolbox™ Software

This table summarizes what's new in Version 4.0 (R14SP3):

| New Features and Changes | Version Compatibility Considerations | Fixed Bugs and Known Problems | Related Documentation at Web Site |
|---|---|---|---|
| Yes<br>Details below | No | Bug Reports | No |

New features and changes introduced in this version are:



## New Interest Rate Models

Two interest rate models have been introduced with Version 4.0:

- 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 Financial Derivatives Toolbox™ software 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

| Function | Purpose |
|---|---|
| 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

| Function | Purpose |
|---|---|
| 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

| Function | Purpose |
|---|---|
| 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. |

| Function | Purpose |
|---|---|
| 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

| Function | Purpose |
|---|---|
| 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

| Function | Purpose |
|---|---|
| cvtree | Convert inverse discount tree to interest-rate tree. |

| Function | Purpose |
|---|---|
| `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™ Software

This table summarizes what's new in Version 3.0 (R14):

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

New features and changes introduced in this version are:


- "Support for Equity Derivatives" on page 20
- "Enhancement to the treeviewer Function" on page 22


## Support for Equity Derivatives

Starting with Version 3.0, Financial Derivatives Toolbox™ software 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

The following set of functions has been added to the toolbox for Version 3.0.

### Price and Sensitivity from Cox-Ross-Rubinstein Trees

| Function | Purpose |
|---|---|
| `crrprice` | Instrument prices from a CRR tree. |
| `crrsens` | Instrument prices and sensitivities by a CRR tree. |
| `crrtimespec` | Specify time structure for a CRR tree. |
| `crrtimespec` | Construct a CRR stock tree. |

### Cox-Ross-Rubinstein Utilities

| Function | Purpose |
|---|---|
| `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

| Function | Purpose |
|---|---|
| `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

| Function | Purpose |
|---|---|
| `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

| Function | Purpose |
|---|---|
| `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 Probabilities (EQP) equity trees as input.

# Compatibility Summary for Financial Derivatives Toolbox™ Software

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 V5.2 (R2008a)** | None |
| V5.1 (R2007b) | None |
| V5.0 (R2007a) | None |
| V4.1 (R2006b) | None |
| V4.0.1 (R2006a) | None |
| V4.0 (R14SP3) | None |
| V3.0 (R14) | None |