Financial Derivatives Toolbox Release Notes

The “Financial Derivatives Toolbox 4.0 Release Notes” on page 1-1 describe the changes introduced in the latest version of the Financial Derivatives Toolbox.

If you are upgrading from an earlier version , you should also see

- “Financial Derivatives Toolbox 3.0 Release Notes” on page 2-1
- “Financial Derivatives Toolbox 2.0 Release Notes” on page 3-1.
- “Financial Derivatives Toolbox 1.0 Release Notes” on page 4-1.

Printing the Release Notes

If you would like to print the Release Notes, you can link to a PDF version.

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Financial Derivatives Toolbox 4.0 Release Notes

New Features

This section summarizes the new features and enhancements introduced in the Financial Derivatives Toolbox Version 3.0. These enhancements are:

- Support for Black-Karasinski (BK) and Hull-White (HW) interest rate models
- Support for recombining trinomial trees, used in conjunction with the BK and HW models.
- Enhancement to `treeviewer` function

New Interest Rate Models

The two new interest rate models that have been introduced with Version 4 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 summarized 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.

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Financial Derivatives Toolbox 3.0 Release Notes

New Features

This section summarizes the new features and enhancements introduced in the Financial Derivatives Toolbox Version 3.0. These enhancements are:

- "Support for Equity Derivatives"
- "New Functions in Version 3.0"
- "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.

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Financial Derivatives Toolbox 2.0 Release Notes

New Features

This section introduces the new features and enhancements added in the Financial Derivatives Toolbox 2.0 since Version 1.0 (Release 12.1).

Note The Financial Derivatives Toolbox 2.0 was initially released in Web-downloadable form after Release 12.1 was released, but before Release 13. There are no changes between the post-Release 12.1 version of the Financial Derivatives Toolbox 2.0 and the version shipped with Release 13.

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 upon 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). 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.

Fixed Income Pricing and Sensitivity from Black-Derman-Toy Tree

Function	Purpose
`bdtprice`	Fixed income instrument prices by BDT interest-rate tree
`bdtsens`	Fixed income 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

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Financial Derivatives Toolbox 1.0 Release Notes

Introduction to the Financial Derivatives Toolbox

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.

Interest Rate Models

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

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

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.