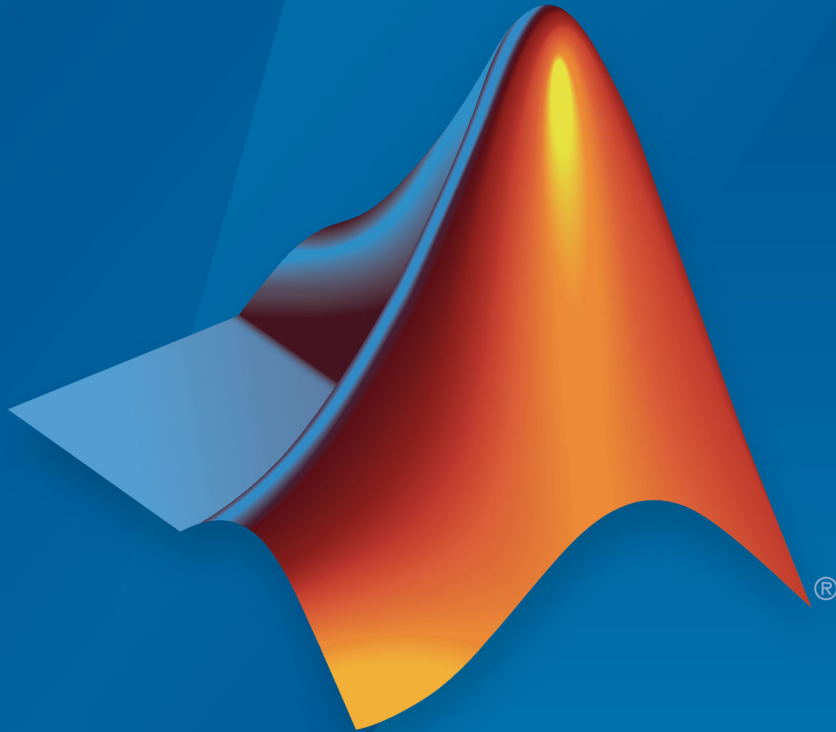


# Financial Instruments Toolbox™ Release Notes



# 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.  
1 Apple Hill Drive  
Natick, MA 01760-2098

## *Financial Instruments Toolbox™ Release Notes*

© COPYRIGHT 2012–2019 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.

## R2019a

---

<b>Normal SABR Model: Support the computation of Normal (Bachelier) volatility for cap or floor volatility stripping . . .</b>	<b>1-2</b>
<b>Finite-Difference Methods: Compute prices and sensitivities of double barrier options using the Alternating Direction Implicit (ADI) and Crank-Nicolson methods . . . . .</b>	<b>1-2</b>
<b>Monte Carlo Simulation: Compute prices and sensitivities of double barrier options using the Black-Scholes option pricing model . . . . .</b>	<b>1-2</b>
<b>Vanilla European Options: Compute prices and sensitivities using the Bates and Merton76 models with finite differences . . . . .</b>	<b>1-2</b>

## R2018b

---

<b>Normal SABR Model: Compute implied Normal (Bachelier) volatility and sensitivity by the SABR model . . . . .</b>	<b>2-2</b>
<b>Finite-Difference Methods: Calculate option prices by the Heston and local volatility models using the Alternating Direction Implicit (ADI) and Crank-Nicolson methods . . . .</b>	<b>2-2</b>
<b>Implied Volatility: Improve performance of the impvbybls and impvbyblk functions when using the Jäckel 2016 method . . . . .</b>	<b>2-2</b>

## R2018a

---

<b>Vanilla European Options: Compute prices and sensitivities using Heston, Bates, and Merton76 models with FFT and numerical integration</b> .....	<b>3-2</b>
<b>Cox-Ingersoll-Ross Lattice Trees: Calculate prices and sensitivities of bonds, caps, floors, swaps, and options</b> ....	<b>3-2</b>
<b>Asian Options: Use Haug, Haug, Margrabe model for discrete arithmetic fixed Asian options and Turnbull-Wakeman model for continuous arithmetic fixed options</b> .....	<b>3-3</b>

## R2017b

---

<b>Interest-Rate Instruments: Price swaptions with resettable legs and different basis conventions using Black, Normal, and lattice (tree-based) models</b> .....	<b>4-2</b>
<b>Interest-Rate Instruments: Use Hull-White calibration routines for Shifted Black and Normal models</b> .....	<b>4-2</b>

## R2017a

---

<b>Interest-Rate Instruments: Price interest rate options with negative rates using normal volatility model and shifted SABR model</b> .....	<b>5-2</b>
<b>Equity Instruments: Price American vanilla options using Barone-Adesi and Whaley model</b> .....	<b>5-2</b>
<b>bkcaplet and bkfloorlet removal</b> .....	<b>5-2</b>

## R2016b

<b>Equity Instruments: Price barrier options with closed form, Crank-Nicolson method, and Monte Carlo simulation . . . . .</b>	<b>6-2</b>
<b>Equity Instruments: Price European options with finite differences method . . . . .</b>	<b>6-2</b>
<b>Hybrid Instruments: Price convertible bonds with a default risk and recovery rate using standard and implied trinomial trees . . . . .</b>	<b>6-2</b>
<b>Numerix CAIL Engine: Access the Numerix Engine directly from MATLAB using an updated API . . . . .</b>	<b>6-3</b>
<b>Functions moved from Financial Instruments Toolbox to Financial Toolbox . . . . .</b>	<b>6-3</b>
<b>help fininstdemos removal . . . . .</b>	<b>6-3</b>
<b>bkcaplet and bkfloorlet removal . . . . .</b>	<b>6-4</b>

## R2016a

<b>Cap and Floor Instruments: Volatility stripping . . . . .</b>	<b>7-2</b>
<b>Swap Instruments: Pricing cross-currency, fixed-fixed, and float-float swaps . . . . .</b>	<b>7-2</b>
<b>cbprice removal . . . . .</b>	<b>7-2</b>

## R2015b

<b>Hybrid Instruments: Price convertible bonds using standard and implied trinomial trees</b> .....	<b>8-2</b>
<b>Equity Instruments: Price equity derivatives using a standard trinomial tree</b> .....	<b>8-2</b>
<b>Simple Interest Convention: Calculate zero curves, forward curves, discount curves, rates, and bootstrapping using simple interest</b> .....	<b>8-2</b>
<b>cbprice removal</b> .....	<b>8-3</b>

## R2015a

<b>Price convertible bonds using CRR and EQP lattice models</b> .....	<b>9-2</b>
<b>Collateral-level computation from credit exposure simulations</b> .....	<b>9-2</b>
<b>Wrong-way risk example</b> .....	<b>9-2</b>

## R2014b

<b>Pricing functionality for forward options</b> .....	<b>10-2</b>
<b>Amortizing caps and floors pricing using lattice models</b> .....	<b>10-2</b>
<b>Power price simulation example</b> .....	<b>10-2</b>

<b>Hull-White single-factor model calibration using volatility surface</b> .....	<b>10-2</b>
<b>SABR option greeks computation</b> .....	<b>10-2</b>
<b>Amortizing caps and floors pricing using closed form solutions (Black or Linear Gaussian two-factor models)</b> .....	<b>10-3</b>
<b>Asian options pricing example</b> .....	<b>10-3</b>
<b>Numerix CrossAsset Integration Layer (CAIL) 11 example</b> .....	<b>10-3</b>

## R2014a

<b>Dual curve construction</b> .....	<b>11-2</b>
<b>Dual curve pricing of caps, floors, and swaptions using the Black model</b> .....	<b>11-2</b>
<b>Dual curve pricing of swaps and floating-rate notes</b> .....	<b>11-2</b>
<b>Monte Carlo and analytical pricing of lookback options</b> .....	<b>11-2</b>
<b>Implied Black volatility computation for the SABR stochastic volatility model</b> .....	<b>11-3</b>
<b>User-specified simulation paths for Longstaff-Schwartz pricing functions</b> .....	<b>11-3</b>
<b>creditexposures function to compute credit exposures from mark-to-market OTC contract values</b> .....	<b>11-3</b>
<b>exposureprofiles function to derive credit exposure profiles from credit exposures</b> .....	<b>11-3</b>
<b>Enhanced pricing functions for instruments and portfolios with cash flows between tree levels</b> .....	<b>11-3</b>

<b>Swing option pricing example</b> .....	<b>11-4</b>
---	-------------

## **R2013b**

<b>Support for Numerix CrossAsset Integration Layer (CAIL) API</b> .....	<b>12-2</b>
<b>Kirk's approximation and Bjerksund-Stensland closed-form pricing models for spread options</b> .....	<b>12-2</b>
<b>Finite difference and Monte Carlo simulation pricing for American spread options</b> .....	<b>12-2</b>
<b>Levy and Kemna-Vorst closed-form pricing and Monte Carlo simulation pricing for Asian options</b> .....	<b>12-3</b>
<b>Additional CDS option pricing functionality for index swaptions</b> .....	<b>12-3</b>
<b>Pricing functions for vanilla options using Monte Carlo simulation</b> .....	<b>12-4</b>
<b>Hedging strategies using spread options example</b> .....	<b>12-4</b>
<b>Pricing European and American spread options example</b> ...	<b>12-4</b>
<b>First-to-default (FTD) swaps example</b> .....	<b>12-4</b>
<b>New function for risky present value of a basis point</b> .....	<b>12-4</b>
<b>optimoptions support</b> .....	<b>12-5</b>
<b>Functions moved from Financial Instruments Toolbox to Financial Toolbox</b> .....	<b>12-5</b>



## R2013a

<b>Pricing functions for options on floating-rate notes (FRNs)</b> .....	<b>13-2</b>
<b>Pricing functions for FRNs with embedded options</b> .....	<b>13-2</b>
<b>Performance enhancements in implied volatility calculations</b> .....	<b>13-3</b>
<b>Calibration and Monte Carlo simulation of single-factor and multifactor interest-rate models, including Hull-White, Linear Gaussian, and LIBOR Market Models</b> .....	<b>13-3</b>

## R2012b

<b>Merge of Fixed-Income Toolbox and Financial Derivatives Toolbox to Financial Instruments Toolbox</b> .....	<b>14-2</b>
<b>Cap and floor floating-rate note pricing using trees</b> .....	<b>14-2</b>
<b>Forward-swap pricing using trees or term structure</b> .....	<b>14-2</b>
<b>Functions for fitting and extracting calibrated parameters from IRFunctionCurve objects</b> .....	<b>14-3</b>
<b>LIBOR market model example</b> .....	<b>14-3</b>
<b>Counterparty credit risk example</b> .....	<b>14-3</b>
<b>Conversion of error and warning message identifiers</b> .....	<b>14-3</b>



# R2019a

---

**Version: 2.9**

**New Features**

**Bug Fixes**

## **Normal SABR Model: Support the computation of Normal (Bachelier) volatility for cap or floor volatility stripping**

The following functions have the new additional name-value pair argument 'Model' which enables you to specify a 'normal' (Bachelier) volatility for cap or floor volatility stripping:

- capvolstrip
- floorvolstrip

## **Finite-Difference Methods: Compute prices and sensitivities of double barrier options using the Alternating Direction Implicit (ADI) and Crank-Nicolson methods**

The following functions support finite-difference calculations for pricing double barrier options:

- dblbarrierbyfd
- dblbarriersensbyfd

## **Monte Carlo Simulation: Compute prices and sensitivities of double barrier options using the Black-Scholes option pricing model**

The following functions support the double barrier options and sensitivities using the Black-Scholes option pricing model:

- dblbarrierbybls
- dblbarriersensbybls

## **Vanilla European Options: Compute prices and sensitivities using the Bates and Merton76 models with finite differences**

The following functions support computing prices and sensitivities for vanilla European options with the Bates and Merton76 models using finite differences:

- 
- `optByBatesFD`
  - `optSensByBatesFD`
  - `optByMertonFD`
  - `optBySensMertonFD`



# R2018b

---

**Version: 2.8**

**New Features**

**Bug Fixes**

## **Normal SABR Model: Compute implied Normal (Bachelier) volatility and sensitivity by the SABR model**

The following functions support the computation of the implied Normal (Bachelier) volatility and sensitivities using the SABR model:

- `normalvolbysabr`
- `optsensbysabr`

## **Finite-Difference Methods: Calculate option prices by the Heston and local volatility models using the Alternating Direction Implicit (ADI) and Crank-Nicolson methods**

The following new functions support finite-difference calculations for option prices:

- `optByLocalVolFD`
- `optSensByLocalVolFD`
- `optByHestonFD`
- `optSensByHestonFD`

## **Implied Volatility: Improve performance of the `impvbybls` and `impvbyblk` functions when using the Jäckel 2016 method**

Improve performance of `impvbybls` and `impvbyblk` by using a new name-value pair argument for 'Method' with the value of 'search' or 'jackel2016'. For computing implied volatility, the default value is 'jackel2016'.



# R2018a

---

**Version: 2.7**

**New Features**

**Bug Fixes**

## **Vanilla European Options: Compute prices and sensitivities using Heston, Bates, and Merton76 models with FFT and numerical integration**

The following functions support computing prices and sensitivities for vanilla European options with the Heston, Bates, and Merton76 models using fast Fourier transform (FFT) or fractional Fourier transform (FRFT) and numerical integration:

- `optByHestonFFT`
- `optSensByHestonFFT`
- `optByHestonNI`
- `optSensByHestonNI`
- `optByBatesFFT`
- `optSensByBatesFFT`
- `optByBatesNI`
- `optSensByBatesNI`
- `optByMertonFFT`
- `optSensByMertonFFT`
- `optByMertonNI`
- `optSensByMertonNI`

## **Cox-Ingersoll-Ross Lattice Trees: Calculate prices and sensitivities of bonds, caps, floors, swaps, and options**

The following functions support Cox-Ingersoll-Ross (CIR) lattice trees:

- `cirtree`
- `cirprice`
- `cirsens`
- `bondbycir`
- `capbycir`
- `cfbycir`
- `cirtimespec`

- 
- `cirvolspec`
  - `fixedbycir`
  - `floatbycir`
  - `floorbycir`
  - `oasbycir`
  - `optbndbycir`
  - `optembndbycir`
  - `optfloatbycir`
  - `optemfloatbycir`
  - `rangefloatbycir`
  - `swapbycir`
  - `swaptionbycir`

### **Asian Options: Use Haug, Haug, Margrabe model for discrete arithmetic fixed Asian options and Turnbull-Wakeman model for continuous arithmetic fixed options**

Support for Haug, Haug, Margrabe model for discrete arithmetic fixed Asian options using the following functions:

- `asianbyhbm`
- `asiansensbyhbm`

Support for Turnbull-Wakeman model for continuous arithmetic fixed Asian options using the following functions:

- `asianbytw`
- `asiansensbytw`



# R2017b

---

**Version: 2.6**

**New Features**

**Bug Fixes**

## **Interest-Rate Instruments: Price swaptions with resettable legs and different basis conventions using Black, Normal, and lattice (tree-based) models**

The following functions support different swaption leg reset and basis conventions for lattice, Black, and Normal models:

- `instswaption`
- `swaptionbyblk`
- `swaptionbynormal`
- `swaptionbybdt`
- `swaptionbyhw`
- `swaptionbybk`
- `swaptionbyhjm`

## **Interest-Rate Instruments: Use Hull-White calibration routines for Shifted Black and Normal models**

Calibration routines for the following functions support the Shifted Black model and the Normal (Bachelier) model (which can handle negative interest rates):

- `hwcalbycap`
- `hwcalbyfloor`

# R2017a

---

**Version: 2.5**

**New Features**

**Bug Fixes**

**Compatibility Considerations**

## **Interest-Rate Instruments: Price interest rate options with negative rates using normal volatility model and shifted SABR model**

The following functions support the normal volatility model (Bachelier model) for interest-rate options to handle negative rates:

- `swaptionbynormal`
- `capbynormal`
- `floorbynormal`

The following functions provide an optional `Shift` argument to support the shifted Black model and the shifted SABR model for interest-rate options to handle negative rates:

- `blackvolbysabr` (Shifted SABR)
- `optsensbysabr` (Shifted SABR)
- `swaptionbyblk` (Shifted Black)
- `capbyblk` (Shifted Black)
- `floorbyblk` (Shifted Black)
- `capvolstrip` (Shifted Black)
- `floorvolstrip` (Shifted Black)

## **Equity Instruments: Price American vanilla options using Barone-Adesi and Whaley model**

Support for American vanilla options using the Barone-Adesi and Whaley model:

- `optstockbybaw`
- `optstocksensbybaw`
- `impvbybaw`

## **bkcaplet and bkfloorlet removal**

`bkcaplet` and `bkfloorlet` will be removed in a future release. Use `capbyblk` and `floorbyblk` instead.



---

## Compatibility Considerations

Function Name	What Happens When You Use This Function	Use This Function Instead	Compatibility Considerations
bkcaplet and bkfloorlet	Errors	capbyblk or floorbyblk	Replace all instances of bkcaplet and bkfloorlet with capbyblk or floorbyblk.



# R2016b

---

**Version: 2.4**

**New Features**

**Bug Fixes**

**Compatibility Considerations**

## **Equity Instruments: Price barrier options with closed form, Crank-Nicolson method, and Monte Carlo simulation**

The following functions support barrier options for equity or energy derivatives:

- `barrierbyfd` calculates barrier option prices using finite difference method.
- `barriersensbyfd` calculates barrier option prices and sensitivities using finite difference method.
- `barrierbybls` calculates prices for a European barrier option using Black-Scholes option pricing model.
- `barriersensbybls` calculates prices and sensitivities for a European barrier option using Black-Scholes option pricing model.
- `barrierbybls` calculates barrier option prices using Longstaff-Schwartz model.
- `barriersensbybls` calculates barrier option prices and sensitivities using Longstaff-Schwartz model.

## **Equity Instruments: Price European options with finite differences method**

The following functions support vanilla options for equity derivatives:

- `optstockbyfd` calculates vanilla option prices using finite differences method.
- `optstocksensbyfd` calculates vanilla option prices and sensitivities using finite differences method.

## **Hybrid Instruments: Price convertible bonds with a default risk and recovery rate using standard and implied trinomial trees**

Support for default for risk and recovery rate using `cbondbycrr`, `cbondbyeqp`, `cbondbystt`, and `cbondbyitt`. To specify a convertible bond risk and recovery rate, use the name-value pair arguments for `DefaultProbability` and `RecoveryRate`.

---

## **Numerix CAIL Engine: Access the Numerix Engine directly from MATLAB using an updated API**

Support for an updated Numerix® CAIL API, using the `numerixCrossAsset` object and the associated methods for: `applicationCall`, `applicationData`, `applicationMatrix`, `getdata`, and `close`.

## **Functions moved from Financial Instruments Toolbox to Financial Toolbox**

The following functions are moved from Financial Instruments Toolbox to Financial Toolbox™:

- `cdsbootstrap` calculates barrier option prices using finite difference method.
- `cdsprice` calculates barrier option prices and sensitivities using finite difference method.
- `cdsspread` calculates price for a European barrier options using Black-Scholes option pricing model.
- `cdsrpv01` calculates price and sensitivities for a European barrier options using Black-Scholes option pricing model.
- `creditlexposures` computes credit exposures from contract values.
- `exposureprofiles` compute exposure profiles from credit exposures.

## **help fininstdemos removal**

The `help fininstdemos` command is removed in this release. Use the `demo` command instead.

## Compatibility Considerations

Command Name	What Happens When You Use This Command	Use This Command Instead	Compatibility Considerations
help fininstdemo s	Errors	demo 'toolbox' 'financial instruments'	Replace all instances of help fininstdemo with demo 'toolbox' 'financial instruments'.

## bkcaplet and bkfloorlet removal

bkcaplet and bkfloorlet will be removed in a future release. Use capbyblk and floorbyblk instead.

## Compatibility Considerations

Function Name	What Happens When You Use This Function	Use This Function Instead	Compatibility Considerations
bkcaplet and bkfloorlet	Warns	capbyblk or floorbyblk	Replace all instances of bkcaplet and bkfloorlet with capbyblk or floorbyblk.

# R2016a

---

**Version: 2.3**

**New Features**

**Bug Fixes**

**Compatibility Considerations**

## Cap and Floor Instruments: Volatility stripping

The following functions support cap and volatility stripping for interest-rate instruments:

- `capvolstrip` strips caplet volatilities from flat cap volatilities.
- `floorvolstrip` strips floorlet volatilities from flat floor volatilities.

## Swap Instruments: Pricing cross-currency, fixed-fixed, and float-float swaps

Support for pricing cross-currency swaps using `swapbyzero`. Support for fixed-fixed and float-float swaps is added to `instswap`, `swapbybdt`, `swapbyhjm`, `swapbybdt`, `swapbybk`, `swapbyzero`.

## cbprice removal

`cbprice` is removed in this release. Use `cbondbycrr`, `cbondbyeqp`, `cbondbyitt`, or `cbondbystt` instead.

## Compatibility Considerations

Function Name	What Happens When You Use This Function	Use This Function Instead	Compatibility Considerations
<code>cbprice</code>	Errors	<code>cbondbycrr</code> , <code>cbondbyeqp</code> , <code>cbondbyitt</code> , or <code>cbondbystt</code>	Replace all instances of <code>cbprice</code> with <code>cbondbycrr</code> , <code>cbondbyeqp</code> , <code>cbondbyitt</code> , or <code>cbondbystt</code> .



# R2015b

---

**Version: 2.2**

**New Features**

**Bug Fixes**

**Compatibility Considerations**

## Hybrid Instruments: Price convertible bonds using standard and implied trinomial trees

The following functions support building a standard trinomial tree:

- `stttree`
- `stttimespec`

`cbondbystt` supports pricing a convertible bond using an `STTTtree`.

`ITTree` now supports pricing convertible bonds with `cbondbyitt`.

## Equity Instruments: Price equity derivatives using a standard trinomial tree

`STTTtree` supports pricing for equity derivatives.

The following modified functions support the following equity instruments:

- Asian options — `asianbystt`
- Lookback options — `lookbackbystt`
- Barrier options — `barrierbystt`
- Vanilla options — `optstockbystt`
- Compound options — `compoundbystt`
- `sttprice`
- `sttsens`

## Simple Interest Convention: Calculate zero curves, forward curves, discount curves, rates, and bootstrapping using simple interest

Simple interest support for the following functions.

- `rate2disc` — Support added for `Compounding = 0` for simple interest where there is no compounding.
- `disc2rate` — Support added for `Compounding = 0` for simple interest where there is no compounding.

- `ratetimes` — Support added for `Compounding = 0` for simple interest where there is no compounding.
- `IRDataCurve` — Support added for `Compounding = 0` for simple interest for “zero” and “discount” curve types only (not supported for “forward” curves) where there is no compounding.
- `getForwardRates` — Support added for `Compounding = 0` for simple interest where there is no compounding.
- `getZeroRates` — Support added for `Compounding = 0` for simple interest where there is no compounding.
- `bootstrap` — Support added for `Compounding = 0` for simple interest for “zero” and “discount” curve types only (not supported for “forward” curves) where there is no compounding.
- `intenvset` — Support added for `Compounding = 0` for simple interest where there is no compounding.

## cbprice removal

`cbprice` will be removed in a future release. Use `cbondbycrr`, `cbondbyeqp`, `cbondbyitt`, or `cbondbystt` instead.

## Compatibility Considerations

Function Name	What Happens When You Use This Function	Use This Function Instead	Compatibility Considerations
<code>cbprice</code>	Warns	<code>cbondbycrr</code> , <code>cbondbyeqp</code> , <code>cbondbyitt</code> , or <code>cbondbystt</code>	Replace all instances of <code>cbprice</code> with <code>cbondbycrr</code> , <code>cbondbyeqp</code> , <code>cbondbyitt</code> , or <code>cbondbystt</code> .



# R2015a

---

**Version: 2.1**

**New Features**

**Bug Fixes**

## Price convertible bonds using CRR and EQP lattice models

`cbondbycrr` and `cbondbyeqp` calculate the price of convertible bonds using the Tsiveriotis and Fernandes model. `instcbond` is the constructor for the CBond instrument type

The following modified functions support the new convertible bond (CBond) instrument:

- `instadd`
- `instdisp`
- `crrprice`
- `eqpprice`
- `crrsens`
- `eqpsens`

## Collateral-level computation from credit exposure simulations

`creditexposures` is enhanced to support computing exposures for counterparties under collateral agreements.

## Wrong-way risk example

The example for modeling wrong-way risk for counterparty credit risk using a Gaussian copula is available as `Example_WrongWayRisk.m` at `\finist\fininstdemos`. For more information, see *Wrong Way Risk with Copulas*.

# R2014b

---

**Version: 2.0**

**New Features**

**Bug Fixes**

## Pricing functionality for forward options

Support is provided for pricing forward options using a modified Black approximation model with `optstockbyblk` and `optstocksensbyblk` using a new name-value pair argument for `ForwardMaturity`, which is the maturity date of the forward contract.

## Amortizing caps and floors pricing using lattice models

Support is provided for name-value pair argument, `Principal`, to pass the schedule to compute the price for amortizing caps (`capbybdt`, `capbybk`, `capbyhjm`, and `capbyhw`) and floors (`floorbybdt`, `floorbybk`, `floorbyhjm`, and `floorbyhw`). In addition, `instcap` and `instfloor` are enhanced to support the creation of cap and floor instruments with amortizing caps and floors.

## Power price simulation example

The example for simulating power price and mean reverting jump diffusion is available as `SimulateElectricityPricesExample.m` at `\fininst\fininstdemos`. For more information, see [Simulating Electricity Prices with Mean-Reversion and Jump-Diffusion](#).

## Hull-White single-factor model calibration using volatility surface

`hwcalbycap` and `hwcalbyfloor` support a new syntax.

```
[Alpha, Sigma, OptimOut] = hwcalbycap(RateSpec, MarketStrike, MarketMaturity, MarketVolatility)
```

```
[Alpha, Sigma, OptimOut] = hwcalbyfloor(RateSpec, MarketStrike, MarketMaturity, MarketVolatility)
```

The `Strike`, `Settle`, and `Maturity` input arguments are no longer required input arguments. By omitting these input arguments, you can use the `MarketStrike`, `MarketMaturity`, and `MarketVolatility` input arguments calibrate the HW model using the entire cap or floor surface.

## SABR option greeks computation

Support is provided for `Delta`, `Vega`, `ModifiedDelta`, and `ModifiedVega` sensitivities for the SABR stochastic model using `optsensbysabr`.



---

## **Amortizing caps and floors pricing using closed form solutions (Black or Linear Gaussian two-factor models)**

For the Black model, support is available for an enhanced name-value pair argument, `Principal`, to pass the schedule to compute the price for amortizing caps (`capbyblk`) and floors (`floorbyblk`). For the Linear Gaussian two-factor model, support is available for an enhanced name-value pair argument, `Notional`, to pass the schedule to compute the price for amortizing caps (`capbylg2f`) and floors (`floorbylg2f`).

### **Asian options pricing example**

The example comparing multiple approaches to pricing Asian options is available as `AsianOptionExample.m` at `\fininst\fininstdemos`. For more information, see [Pricing Asian Options](#).

### **Numerix CrossAsset Integration Layer (CAIL) 11 example**

The example for Numerix CAIL 11 support is available at `\fininst\fininstdemos\NumerixFileProcessor.m`.



# R2014a

---

**Version: 1.3**

**New Features**

**Bug Fixes**

## Dual curve construction

Support for bootstrapping an interest rate curve using a different curve for discounting the cash flows with the following enhancements:

- `bootstrap` accepts a new optional input argument for `DiscountCurve`.
- `bootstrap` accepts a new bootstrapping instrument type called `FRA` for a forward rate agreement instrument.

For more information on using `bootstrap` for dual curve construction, see the example: `Dual Curve Bootstrapping`.

## Dual curve pricing of caps, floors, and swaptions using the Black model

`capbyblk`, `floorbyblk`, and `swaptionbyblk` accept an optional input argument for `ProjectionCurve`.

## Dual curve pricing of swaps and floating-rate notes

`swapbyzero` and `floatbyzero` have new examples to demonstrate pricing a swap and a floating-rate note with two curves.

## Monte Carlo and analytical pricing of lookback options

Support for lookback options using closed-form solutions or Monte Carlo simulations.

Function	Purpose
<code>lookbackbycvsg</code>	Calculate prices of European lookback fixed- and floating-strike options using the Conze-Viswanathan and Goldman-Sosin-Gatto models.
<code>lookbacksensbycvsg</code>	Calculate prices and sensitivities of European fixed- and floating-strike lookback options using the Conze-Viswanathan and Goldman-Sosin-Gatto models.
<code>lookbackbyls</code>	Calculate prices of lookback fixed- and floating-strike options using the Longstaff-Schwartz model.

Function	Purpose
lookbacksensbyls	Calculate prices and sensitivities of lookback fixed- and floating-strike options using the Longstaff-Schwartz model.

## **Implied Black volatility computation for the SABR stochastic volatility model**

Support for `blackvolbysabr` to calibrate the SABR model parameters and to compute SABR implied Black volatilities.

## **User-specified simulation paths for Longstaff-Schwartz pricing functions**

Support for `optpricebysim` to calculate the price and sensitivities of European or American call or put options based on simulation results of the underlying asset. For American options, the Longstaff-Schwartz least squares method is used to calculate the early exercise premium.

## **creditexposures function to compute credit exposures from mark-to-market OTC contract values**

Support for computing credit exposures as a part of a counterparty credit risk workflow. For more information, see `creditexposures`.

## **exposureprofiles function to derive credit exposure profiles from credit exposures**

Support for computing various credit exposure profiles, including potential future exposure and expected exposure. For more information, see `exposureprofiles`.

## **Enhanced pricing functions for instruments and portfolios with cash flows between tree levels**

The pricing algorithms for vanilla stock options have been enhanced to support `ExerciseDates` between tree levels. While `ExerciseDates` previously allowed only values that coincided with tree dates, the new pricing algorithm allows arbitrary

ExerciseDates between the tree valuation date and tree maturity. For more information see the Bermuda option examples in `optstockbycrr`, `optstockbyeqp`, and `optstockbyitt`.

## **Swing option pricing example**

New example for Pricing Swing Options using the Longstaff-Schwartz Method.

# R2013b

---

**Version: 1.2**

**New Features**

**Compatibility Considerations**

## Support for Numerix CrossAsset Integration Layer (CAIL) API

Support for accessing Numerix instruments and risk models.

Class	Purpose
<code>numerix</code>	Create a numerix object to set up the Numerix CrossAsset Integration Layer (CAIL) environment.

Method	Purpose
<code>numerix.parseResults</code>	Converts Numerix CAIL data to MATLAB® data types.

## Kirk's approximation and Bjerksund-Stensland closed-form pricing models for spread options

Support pricing and sensitivity of spread options for the energy market using closed-form solutions.

Function	Purpose
<code>spreadbykirk</code>	Price European spread options using the Kirk pricing model.
<code>spreadsensbykirk</code>	Calculate European spread option prices and sensitivities using the Kirk pricing model.
<code>spreadbybjs</code>	Price European spread options using the Bjerksund-Stensland pricing model.
<code>spreadsensbybjs</code>	Calculate European spread option prices and sensitivities using the Bjerksund-Stensland pricing model.

## Finite difference and Monte Carlo simulation pricing for American spread options

Support pricing and sensitivity of spread options for the energy market using Monte Carlo simulation.



<b>Function</b>	<b>Purpose</b>
spreadbyfd	Price European or American spread options using the Alternate Direction Implicit (ADI) finite difference method.
spreadsensbyfd	Calculate price and sensitivities of European or American spread options using the Alternate Direction Implicit (ADI) finite difference method.
spreadbyls	Price European or American spread options using Monte Carlo simulations.
spreadsensbyls	Calculate price and sensitivities for European or American spread options using Monte Carlo simulations.

## **Levy and Kemna-Vorst closed-form pricing and Monte Carlo simulation pricing for Asian options**

Support pricing and sensitivity of Asian options for the energy market using Monte Carlo simulation and closed-form solutions.

<b>Function</b>	<b>Purpose</b>
asianbyls	Price European or American Asian options using the Longstaff-Schwartz model.
asiansensbyls	Calculate prices and sensitivities of European or American Asian options using the Longstaff-Schwartz model.
asianbykv	Price European geometric Asian options using the Kemna-Vorst model.
asiansensbykv	Calculate prices and sensitivities of European geometric Asian options using the Kemna-Vorst model.
asianbylevy	Price European arithmetic Asian options using the Levy model.
asiansensbylevy	Calculate prices and sensitivities of European arithmetic Asian options using the Levy model.

## **Additional CDS option pricing functionality for index swaptions**

New example for Pricing a CDS Index Option.

## Pricing functions for vanilla options using Monte Carlo simulation

Support pricing and sensitivity of vanilla options for the energy market using Monte Carlo simulation.

Function	Purpose
optstockbyls	Price European, Bermudan, or American vanilla options using the Longstaff-Schwartz model.
optstocksensbyls	Calculate European, Bermudan, or American vanilla option prices and sensitivities using the Longstaff-Schwartz model.

## Hedging strategies using spread options example

New example for Hedging Strategies Using Spread Options.

## Pricing European and American spread options example

New example for Pricing European and American Spread Options.

## First-to-default (FTD) swaps example

New example for First-to-Default Swaps.

## New function for risky present value of a basis point

`cdsrpv01` computes risky present value of a basis point (RPV01) for a credit default swap (CDS) and conforms to the industry standards (ISDA CDS Standard Model).

## Compatibility Considerations

Compared with the previous version of Financial Instruments Toolbox, there are minor changes in the values computed by `cdsbootstrap`, `cdsspread`, `cdsprice`, and `cdsoptprice` when the starting dates do not fall on a payment date. The affected output arguments are as follows:

- 
- `cdsbootstrap`: ProbData, HazData
  - `cdspread`: Spread
  - `cdsprice`: Price
  - `cdsoptprice`: Payer, Receiver

While the magnitudes of the value changes are very small, they might affect users who depend on exact matches to previous values. These changes are caused by the modification of the way risky present value of a basis point (RPV01) is computed and these changes were made to better reflect the industry practice of paying CDS premiums only on specific payment dates.

## **optioptions support**

optioptions support for `IRFitOptions`, `fitFunction` method, `hwcalbycap`, and `hwcalbyfloor`.

## **Functions moved from Financial Instruments Toolbox to Financial Toolbox**

The following functions are moved from Financial Instruments Toolbox to Financial Toolbox:

- `cdai`
- `cdprice`
- `cdyield`
- `tbilldisc2yield`
- `tbillprice`
- `tbillrepo`
- `tbillval01`
- `tbillyield`
- `tbillyield2disc`



# R2013a

---

**Version: 1.1**

**New Features**

## Pricing functions for options on floating-rate notes (FRNs)

Support for pricing a floating-rate note instrument with an option using tree models.

Function	Purpose
optfloatbybdt	Price an option for a floating-rate note using a Black-Derman-Toy interest-rate tree.
optfloatbyhjm	Price an option for a floating-rate note using a Heath-Jarrow-Morton interest-rate tree.
optfloatbyhw	Price an option for a floating-rate note using a Hull-White interest-rate tree.
optfloatbybk	Price an option for a floating-rate note using a Black-Karasinski interest-rate tree.
instoptfloat	Define the option instrument for a floating-rate note.

## Pricing functions for FRNs with embedded options

Support for pricing a floating-rate note instrument with an embedded option using tree models.

Function	Purpose
optemfloatbybdt	Price an embedded option for a floating-rate note using a Black-Derman-Toy interest-rate tree.
optemfloatbybk	Price an embedded option for a floating-rate note using a Black-Karasinski interest-rate tree.
optemfloatbyhjm	Price an embedded option for a floating-rate note using a Heath-Jarrow-Morton interest-rate tree.
optemfloatbyhw	Price an embedded option for a floating-rate note using a Hull-White interest-rate tree.
instoptemfloat	Define the floating-rate note with an embedded option instrument.

---

## Performance enhancements in implied volatility calculations

Improved performance for calculating implied volatility when using `impvbybjs` and `impvbyrgw`.

## Calibration and Monte Carlo simulation of single-factor and multifactor interest-rate models, including Hull-White, Linear Gaussian, and LIBOR Market Models

Support for pricing interest-rate instruments for caps, floors, and swaptions using Monte Carlo simulation with Hull-White, Shifted Gaussian, and LIBOR Market Models. There are three new classes, three new methods, and four new functions.

Class	Purpose
<code>HullWhite1F</code>	Create a Hull-White one-factor model.
<code>LinearGaussian2F</code>	Create a two-factor additive Gaussian interest-rate model.
<code>LiborMarketModel</code>	Create a LIBOR Market Model.

Method	Purpose
<code>HullWhite1F.simTermStructs</code>	Simulate term structures for a Hull-White one-factor model.
<code>LinearGaussian2F.simTermStructs</code>	Simulate term structures for a two-factor additive Gaussian interest-rate model.
<code>LiborMarketModel.simTermStructs</code>	Simulate term structures for a LIBOR Market Model.

Function	Purpose
<code>capbylg2f</code>	Price caps using a Linear Gaussian two-factor model.
<code>floorbylg2f</code>	Price floors using a Linear Gaussian two-factor model.
<code>swaptionbylg2f</code>	Price European swaptions using a Linear Gaussian two-factor model.
<code>blackvolbyrebonato</code>	Compute the Black volatility for a LIBOR Market Model using the Rebonato formula.





# R2012b

---

**Version: 1.0**

**New Features**

**Compatibility Considerations**

## Merge of Fixed-Income Toolbox and Financial Derivatives Toolbox to Financial Instruments Toolbox

Fixed-Income Toolbox™ and Financial Derivatives Toolbox™ are merged into the new product Financial Instruments Toolbox.

### Cap and floor floating-rate note pricing using trees

Support for pricing capped, collared, and floored floating-rate notes using the `CapRate` and `FloorRate` arguments.

Function	Purpose
<code>floatbybdt</code>	Price a capped floating-rate note using a Black-Derman-Toy interest-rate tree.
<code>floatbyhjm</code>	Price a capped floating-rate note using a Heath-Jarrow-Morton interest-rate tree.
<code>floatbyhw</code>	Price a capped floating-rate note using a Hull-White interest-rate tree.
<code>floatbybk</code>	Price a capped floating-rate note using a Black-Karasinski interest-rate tree.
<code>instfloat</code>	Create a capped floating-rate note instrument.
<code>instadd</code>	Add capped floating-rate note instruments to a portfolio.

### Forward-swap pricing using trees or term structure

Support for interest-rate forward swaps using the new `StartDate` argument to define the future date for the swap instrument.

Function	Purpose
<code>swapbyzero</code>	Price a bond using a set of zero curves.
<code>swapbybdt</code>	Price a forward swap using a Black-Derman-Toy interest-rate tree.
<code>swapbyhjm</code>	Price a forward swap using a Heath-Jarrow-Morton interest-rate tree.

Function	Purpose
swapbyhw	Price a forward swap using a Hull-White interest-rate tree.
swapbybk	Price a forward swap using a Black-Karasinski interest-rate tree.
instswap	Create a forward swap instrument.
instadd	Add forward swap instruments to a portfolio.

## Functions for fitting and extracting calibrated parameters from IRFunctionCurve objects

New enhancements for IRFunctionCurve object, including the ability to get calibrated parameters, the ability to specify linear inequality parameter constraints, and support for curve type in fitSmoothingSpline to be forward, zero, and discount.

## LIBOR market model example

New example for mortgage prepayment that uses a LIBOR market model to generate interest-rate evolutions. For more information, see Prepayment Modeling with a Two Factor Hull White Model and a LIBOR Market Model.

## Counterparty credit risk example

New example for computing the unilateral Credit Value (Valuation) Adjustment (CVA) for a bank holding a portfolio of vanilla interest-rate swaps with several counterparties. For more information, see Counterparty Credit Risk and CVA.

## Conversion of error and warning message identifiers

For R2012b, error and warning message identifiers have changed in Financial Instruments Toolbox.

## Compatibility Considerations

If you have scripts or functions that use message identifiers that changed, you must update the code to use the new identifiers. Typically, message identifiers are used to turn

off specific warning messages, or in code that uses a `try/catch` statement and performs an action based on a specific error identifier.

For example, because Fixed-Income Toolbox and Financial Derivatives Toolbox merged to become Financial Instruments Toolbox, the `finfixed` and `finderiv` message identifiers have changed to `fininst`. If your code checks for `finfixed` or `finderiv` message identifiers, you must update it to check for `fininst` instead.

To determine the identifier for an error, run the following command just after you see the error:

```
exception = MException.last;  
MSGID = exception.identifier;
```

To determine the identifier for a warning, run the following command just after you see the warning:

```
[MSG,MSGID] = lastwarn;
```

This command saves the message identifier to the variable `MSGID`.