

# Fixed-Income Toolbox 2.0

## Model and analyze fixed-income securities

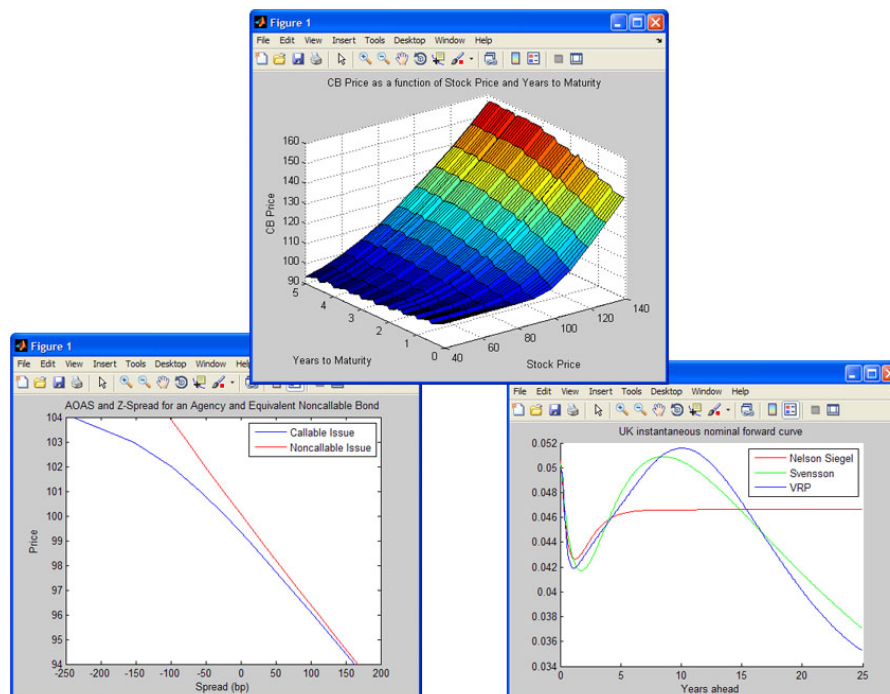
### Introduction

Fixed-Income Toolbox™ provides functions for fixed-income modeling and analysis. The toolbox includes tools for fitting yield curves to market data using parametric fitting models and bootstrapping. You can calculate the price, rates, and sensitivities for interest rate swaps. You can also price and value other derivatives, including credit default swaps, bond futures, and convertible bonds.

Fixed-Income Toolbox also includes tools for determining the price, yield, and cash flow for many types of fixed-income securities, including mortgage-backed securities, corporate bonds, treasury bonds, municipal bonds, certificates of deposit, and treasury bills.

### Key Features

- Yield curve fitting with bootstrapping and parametric fitting models
- Price, rate, and sensitivity calculation for interest rate swaps
- Price and value calculation for credit default swaps
- Price, yield, discount rate, and cash-flow schedule calculation for debt instruments, including treasury bills, zero-coupon bonds, and stepped-coupon bonds
- Price and option adjusted spread calculation for bonds
- Price and rate calculation for convertible bonds, bond futures, and European call and put options
- Price and yield calculation for generic fixed-rate mortgage pools and balloon mortgages

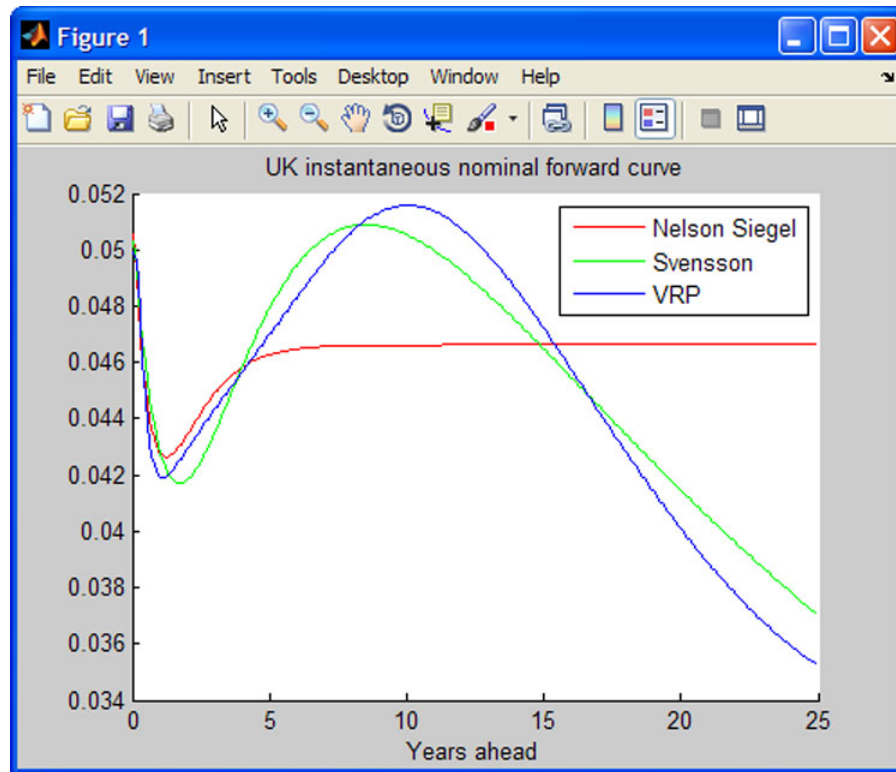


Plots of convertible bond “floor” price as a function of share price and years to maturity (top), agency option adjusted spread for a non-callable bond and Z-Spread for a callable bond issue for a range of bond prices (left), and yield curves fitted to market data using three parametric models (right).

## Yield Curve Fitting and Analysis

Fixed Income Toolbox provides extensible and customizable objects for fitting a yield curve to market data. You can also analyze market data by deriving curves including the forward rate curve, discount rate curve, and par yield curve using other methods of these objects.

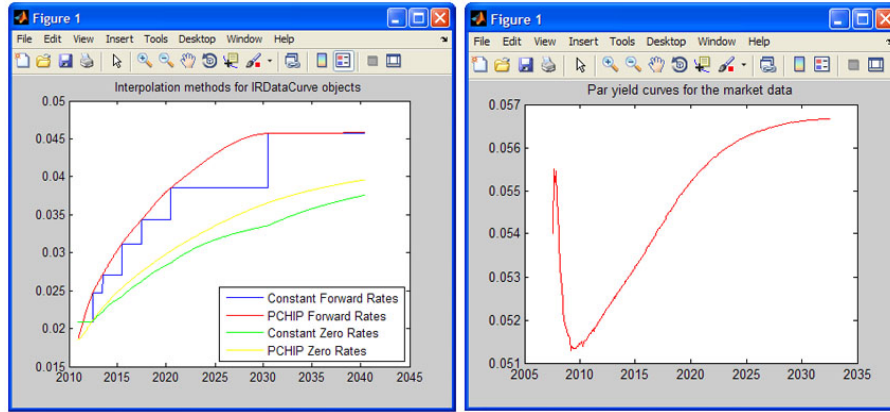
The interest-rate curve objects let you fit yield curves to market data using the bootstrap method, parametric models including Nelson-Siegel and Svensson, spline-based models, and custom functions.



*A plot of yield curves fitted to market data using three parametric models.*

You can analyze yield curves using interest-rate curve objects to derive the discount rates, zero rates, forward rates, and par yields.

You can also convert the interest-rate curve object for use with [Financial Derivatives Toolbox™](#) to model interest-rate structure and price derivative instruments.



Plots of yield curve analysis using forward and zero rates with interpolation methods (left) and par yield curve (right).

## Credit Default Swap Pricing and Valuation

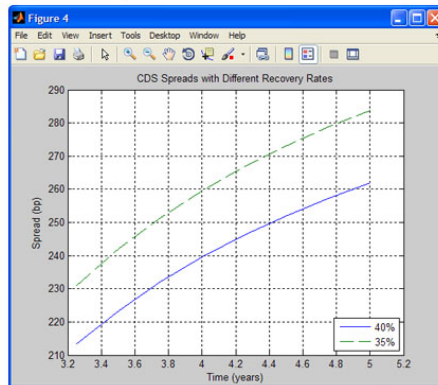
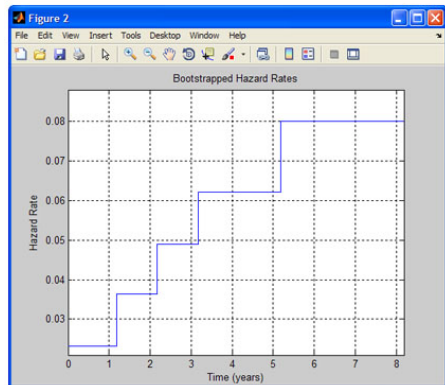
Fixed Income Toolbox includes functions to price new and existing credit default swap (CDS) agreements. You can value running spread CDS contracts with no upfront payments and standard spread contracts that require an upfront payment.

The toolbox simplifies common CDS valuation tasks. You can:

- Estimate the default probability term structure by bootstrapping CDS market data
- Price new CDS contracts by calculating the breakeven spreads for multiple maturity dates and recovery rates
- Calculate the mark-to-market value of a CDS contract with either accrued or no accrued premium payment
- Convert between market quotes using running spreads and contracts valued using upfront payments and standard spreads

```

Editor - C:\MATLAB\work\CDSspreads.m
File Edit Text Go Cell Tools Debug Desktop Window Help
- 1.0 + 1.1 x
% Calculate bootstrapped hazard rates
[ProbData, HazData] = cdsbootstrap(ZeroData, MarketData, Settle);
HazTimes = yearfrac(Settle, HazData(:, 1));
% Calculate spread for 40% recovery rate
Maturity1 = datestr(dayeadd('17-Jul-09', 360*(3.25:0.25:5)), 1);
Spread1 = odspread(ZeroData, ProbData, Settle, Maturity1);
% Calculate spread for 35% recovery rate
Spread1Rec35 = odspread(ZeroData, ProbData, Settle, Maturity1, ...
'RecoveryRate', 0.35);
script Ln 1 Col 1
  
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Code (top) and plots of pricing a CDS contract by bootstrapping hazard rates from CDS market data (bottom, left) and estimating CDS spreads with different recovery rates (bottom, right).

## Debt Instrument Valuation

Fixed-Income Toolbox lets you value and model a variety of debt instruments. You can calculate price and **option adjusted spread (OAS)** for bonds with an embedded option using Black's model.

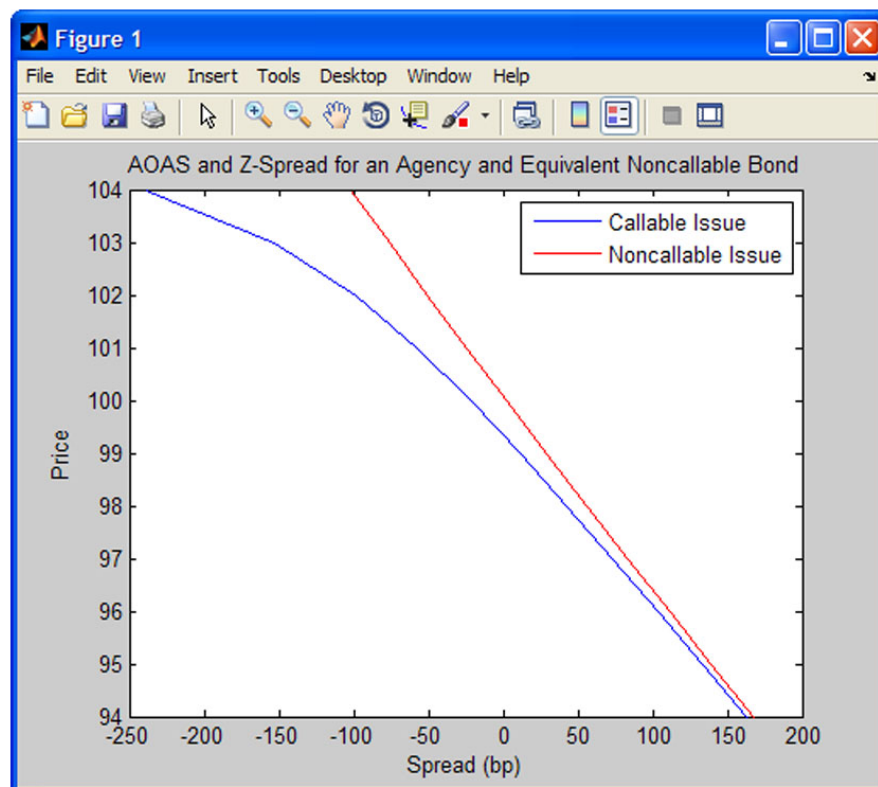
You can price and value a variety of debt instruments:

**Zero-coupon bonds:** Calculate price and yield to extract the present value from any fixed coupon instrument for any time period.

**Treasury bills:** Calculate price, yield, discount rate, and breakeven discount rate.

**Corporate, treasury, and municipal bonds:** Calculate price, yield, and cash-flow schedules.

**Stepped-coupon bonds:** Calculate price, yield, and cash-flow schedules. (The next coupon dates are computed automatically from the last entered input end dates. The payment due on settlement represents the accrued interest due on that day).



*Plot of agency option-adjusted spread for a noncallable bond issue and Z-spread for a callable bond issue for a range of bond prices. This comparison shows that as the price increases, the value of the embedded option in the agency issue increases, and the value of the issue itself does not increase as much as it would for a noncallable bond, demonstrating the negative convexity of this issue.*

## Derivative Instrument Valuation

Fixed-Income Toolbox provides tools based on Black's model for working with fixed-income derivatives.

The toolbox provides tools to calculate the price, par fixed-rate, and duration of Interest rate swaps. These tools let you calculate swap price by computing par yields that equate the floating-rate side of a swap to the fixed-rate side.

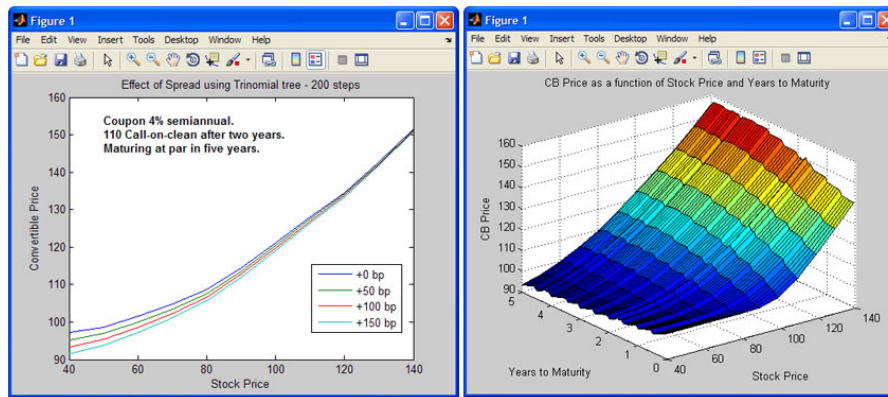
You can set the present value of the fixed side to the present value of the floating side without aligning and

comparing fixed and floating periods. The duration-hedging capabilities let you hedge a portfolio and address interest rate risk with a swap arrangement.

For bond futures, you can calculate the price, bond conversion factors, and implied repo rate. This information can be used to manage interest rate risk for your portfolio.

For convertible bonds, functionality is available to calculate the price using binomial and trinomial trees. The value of the convertible bond is determined by the uncertainty of the relative stock.

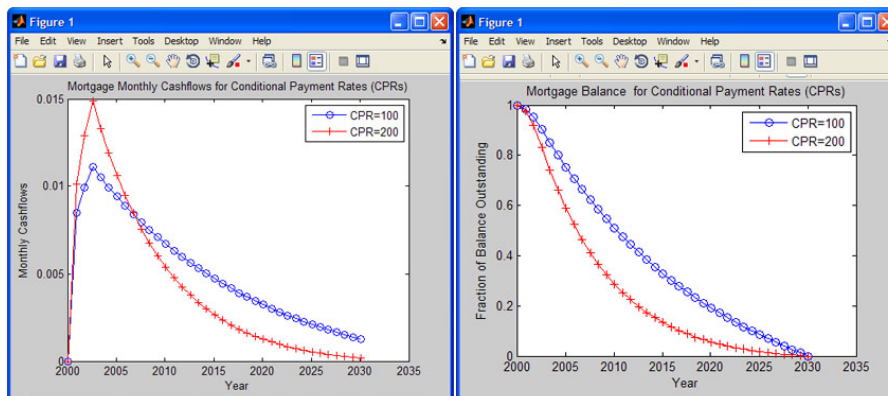
You can also calculate the price using Black's model for a European call option, European put option, interest-rate caplet, and interest rate floorlet.



Plots of convertible bond "floor" when the share prices are low (left) and price as a function of share price and years to maturity (right).

## Mortgage Pool and Balloon Mortgage Pricing

Fixed-Income Toolbox lets you model generic fixed-rate mortgage pools and balloon mortgages. The toolbox provides tools to calculate price and yield of mortgage-backed securities using prepayment options derived from uniform practices of the Public Securities Association (PSA). You can calculate the mortgage-pool price or effective duration using the option adjusted spread method for your mortgage pool. You can also measure the risk for a mortgage-pool portfolio using convexity, duration, and average life calculations.



Plots of mortgage pool monthly cashflows (left) and mortgage balance (right) for two conditional payment rates.

## Resources

### Product Details, Demos, and System Requirements

[www.mathworks.com/products/fixedincome](http://www.mathworks.com/products/fixedincome)

### Trial Software

[www.mathworks.com/trialrequest](http://www.mathworks.com/trialrequest)

### Sales

[www.mathworks.com/contactsales](http://www.mathworks.com/contactsales)

### Technical Support

[www.mathworks.com/support](http://www.mathworks.com/support)

### Online User Community

[www.mathworks.com/matlabcentral](http://www.mathworks.com/matlabcentral)

### Training Services

[www.mathworks.com/training](http://www.mathworks.com/training)

### Third-Party Products and Services

[www.mathworks.com/connections](http://www.mathworks.com/connections)

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