Bond Pricing Configuration in ORE

Acadia - An LSEG Business

30 October 2025

Document Change History

Date	Author	Comment
21 August 2024	Peter Caspers	initial version

Contents

1 Summary

This document describes the bond pricing configuration in ORE.

2 Overview

Bond pricing depends on a number of market data inputs

- ReferenceCurve: a rate curve determining the baseline discounting curve for bond valuation.

- CreditCurve [optional]: a credit curve determining the default probabilty during the lifetime of a bond. This can e.g. be

    - a CDS curve of the same issuer and seniority as the bond to proxy the credit risk
    - a sector-rating curve representing the systematic part of the bond's credit risk
    - a "null" - curve implying zero default risk for pricing, for the purpose of calculating default risk sensitivities or to apply stress scenarios.
    - omitted entirely, implying zero default risk. In this case no default risk sensitivities can be calculated though.

    In all cases, the security spread can be used to represent additional credit / liquidity risk, see below.

- SecuritySpread [optional]: a single additional discounting spread. This can generally be interpreted as part of the credit risk (generating additional default probabilty) or as part of the baseline discounting (liquidity spread). Assumed to be zero if not given. Exception: If a price quote is given and the security spread is configured in the security curve config, but no market data is given for the security spread, the security spread is implied from the price quote.

- Recovery Rate [optional]: the recovery rate that applies in the event of a default of the bond. Assumed to be zero if not given.

- PriceQuote [optional]: a liquid price for the bond, this can be used to imply a security spread such that the market price of the bond matches the theoretical pricing of the bond.

- IncomeCurve [optional]: a repo curve, only relevant for bond forwards, falls back to reference curve if not given

- VolatilityCurve [optional]: a bond volatility surface, only relevant for bond options

The above information is configured in the bond reference data and curve configurations. If the curve configurations are not given as an input, they are auto-generated[1]. Depending on the specific nature of the bond (vanilla fixed rate, floating rate, convertible, callable, ...) additional market data might be needed to price a bond, e.g.

---

[1]this feature might not be available in the public version of ore

- projection curves for floating rate indices

- equity curves, volatilities for convertible bonds

- fx curves, volatilities for cross-currency bonds

- swaption and cds volatilities to calibrate models to price callability

- ...

3   Reference Data

Listing 1 shows and example of reference data of a bond. The bond is identified via its security id (ISIN:XS2257580857). The CreditCurveId has the same name in this case, the reference curve is set to EURIBOR-3M. No income or vol curve is specified for the bond.

Listing 1: Bond reference data (excerpt)

```
<ReferenceData>
  <ReferenceDatum id="ISIN:XS2257580857">
    <Type>ConvertibleBond</Type>
    <ConvertibleBondReferenceData>
      <BondData>
        <IssuerId>CELLNEX TELECOM SA</IssuerId>
        <CreditCurveId>ISIN:XS2257580857</CreditCurveId>
        <ReferenceCurveId>EUR-EURIBOR-3M</ReferenceCurveId>
        <IncomeCurveId/>
        <VolatilityCurveId/>
        ...
```

4   Curve Configurations

4.1   Credit Curve Config

The credit curve represents the survival probability entering the bond pricing. It also provides a recovery rate that is used as a fallback if the recovery rate from the security curve config is not available.

The curve config can either be explicitly set up or ore can auto-generate it. Listing 2 shows an auto-generated config for the bond from section 3:

- Type: The type is set to Null which means that the default probability of this curve is zero. It is set up nevertheless to enable the generation of credit curve sensitivities. No market data is required to build a curve of type Null.

- RecoveryRate: The curve has a recovery rate quote. The wild card allows for recovery rate market data points referencing the security id and optionally seniority, currency, doc clause. Note: The recovery is not used to build the curve in this case, since the type is Null. However, the curve's recovery rate is used in other contexts. For example, it is the fallback value if the recovery rate from the security config is not available.

```xml
<DefaultCurve>
  <CurveId>ISIN:XS2257580857</CurveId>
  <CurveDescription>Autogenerated curve config for Bond Derivatives</CurveDescription>
  <Currency>EUR</Currency>
  <Configurations>
    <Configuration priority="0">
      <RecoveryRate>RECOVERY_RATE/RATE/ISIN:XS2257580857*</RecoveryRate>
      <Type>Null</Type>
      <DayCounter>Actual/365 (Fixed)</DayCounter>
      <DiscountCurve>Yield/EUR/EUR-EONIA</DiscountCurve>
      <Conventions/>
      <Extrapolation>true</Extrapolation>
      <BootstrapConfig> ... </BootstrapConfig>
      <AllowNegativeRates>false</AllowNegativeRates>
    </Configuration>
  </Configurations>
</DefaultCurve>
```

4.2 Security Curve Config

The security curve config points to additional market data used for bond pricing.
It can be explicitly set up or ore can auto-generate it. Listing 3 shows an auto-generated config for the bond from section 3:

- SpreadQuote: Points to the security spread market data point. If it specified in the curve config but not present in the market data feed and a PriceQuote is specified and available in the market data, the security spread value is implied from the price quote. Note: If no SpreadQuote is specified, no security spread will be implied, no matter if a price quote is available.

- RecoveryRateQuote: Points to the recovery rate used for pricing. If this is not available in the market data, the credit curve recovery rate will be used as a fallback, or if no credit curve is specified either, zero will be used.

- PriceQuote: If specified and available in the market data and if SpreadQuote is specified but not available in the market data, the security spread will be implied from the price quote.

Listing 3: Auto-generated default curve config

```xml
<Security>
  <CurveId>ISIN:XS2257580857</CurveId>
  <CurveDescription>Autogenerated Config</CurveDescription>
  <SpreadQuote>BOND/YIELD_SPREAD/ISIN:XS2257580857</SpreadQuote>
  <RecoveryRateQuote>RECOVERY_RATE/RATE/ISIN:XS2257580857</RecoveryRateQuote>
  <PriceQuote>BOND/PRICE/ISIN:XS2257580857</PriceQuote>
</Security>
```

5 Market and Sensitivity Configs

5.1 Todays market configuration

The todays market configuration provides

- a mapping from credit curve ids to default curve configurations

- a mapping from security ids to security curve configurations

Listing 4 shows an auto-generated example. Note that there are two mappings for the default curve. The pricing engine builders will always attempt to retrieve the credit curve from the second label starting with `__SECCRCRV_`. This internal label contains both the security id and the credit curve id from the reference data of this security. The builder will fallback to the usual first label only if the market object under the second label is not available.

This allows to calculate security specific credit curve sensitivities even if several bonds share the same credit curve.

Listing 4: Auto-generated todays market config for credit curves and securities

```
<DefaultCurves id="default">
  <DefaultCurve name="ISIN:XS2257580857">Default/EUR/ISIN:XS2257580857</DefaultCurve>
  <DefaultCurve name="__SECCRCRV_ISIN:XS2257580857_&amp;_ISIN:XS2257580857_&amp;_">
                                   Default/EUR/ISIN:XS2257580857</DefaultCurve>
</DefaultCurves>
<Securities id="default">
  <Security name="ISIN:XS2257580857">Security/ISIN:XS2257580857</Security>
</Securities>
```

Recovery rates are added to todays market for both default curves (the credit curve specific recovery rate) and securities (the security specific recovery rate). In case of an overlap of names, one value will overwrite the other, so it is important to ensure consistent values in this case.

5.2 Simulation configuration

Listing 5 shows an auto-generated simulation market configuration. It lists the credit curves and securities to enable in the simulation. Note the usage of the security specific credit curve label starting with `__SECCRCRV_`, see 5.1 for an explanation.

Similar to todays market, recovery rates are added for both default curves (the credit curve specific recovery rate) and securities (the security specific recovery rate). In case of an overlap of names, one value will overwrite the other, so it is again important to ensure consistent values in this case.

```xml
<DefaultCurves>
  <Names>
    <Name>ISIN:XS2257580857</Name>
    <Name>__SECCRCRV_ISIN:XS2257580857_&amp;_ISIN:XS2257580857_&amp;_</Name>
  </Names>
<Securities>
  <Simulate>true</Simulate>
  <Names>
    <Name>ISIN:XS2257580857</Name>
  </Names>
...
```

5.3 Sensitivity configuration

Listing 6 shows an auto-generated sensitivity config for credit curve sensitivities. Again, this uses the security specific credit curve label starting with `__SECCRCRV_`, see 5.1 for an explanation.

Note: The par conversion depends on the relevant recovery rate. As explained in 5.2, recovery rates are added to the sim market for credit curves (the curve specific recovery rate) and for securities (the security specific recovery rate).

In this example, the credit curve recovery rate will be used though, because the name refers to the security specific credit curve starting with `__SECCRCRV_` and this name appears only in the default curve section of 5, and not the securities section.

Listing 6: Auto-generated sensitivity config for credit curves

```xml
<CreditCurve name="__SECCRCRV_ISIN:XS2257580857_&amp;_ISIN:XS2257580857_&amp;_">
  <Currency>EUR</Currency>
  <ShiftType>Absolute</ShiftType>
  <ShiftSize>0.0001</ShiftSize>
  <ShiftScheme>Forward</ShiftScheme>
  <ShiftTenors>1Y, 2Y, 3Y, 5Y, 10Y</ShiftTenors>
  <ParConversion>
    <Instruments>CDS, CDS, CDS, CDS, CDS</Instruments>
    <SingleCurve>false</SingleCurve>
    <DiscountCurve>EUR-EONIA</DiscountCurve>
    <Conventions>
      <Convention id="CDS">CDS-STANDARD-CONVENTIONS</Convention>
    </Conventions>
  </ParConversion>
</CreditCurve>
```

References

[1] ORE User Guide, http://www.opensourcerisk.org/documentation/