

1 Introduction

This plug-in implements the capability of calculating Asset Swap Spread allowing to include the counterpart risk, of any issuer, on the valuation of quoted or over-the-counter (OTC) bond (also called *custom bond*).

1.1 The Asset Swap (ASW)

An Asset Swap (ASW) is a plain vanilla interest rate swap, fixed vs. floating. The fixed leg have the same payments structure, market convention and fixed rate of a quoted bond (called *benchmark bond*); meanwhile the floating leg is indexed to a floating interest rate (Xibor) defined for a certain maturity.

Each leg is discounted using a Zero Rate Curve obtained from a combination of preselected Cash-FRA-Swap rates.

1.2 The Asset Swap Spread

The ASW spread (ASW_{Spd}) is the rate that nullifies the fair value of an ASW when the clean price of *benchmark bond* quoted is equal to 100 or quoted at par.¹ If the clean price is different from the par, in order to obtain the spread, it is necessary to add the difference between 100 and the quoted clean price ($\Delta BndPrice$) to the fair value of ASW.

The formula to calculate ASW_{Spd} is given by :

$$ASW_{FV}(ASW_{Spd}) + \Delta BndPrice = 0 \quad (1)$$

where

$$ASW_{FV}(ASW_{Spd}) = (Fixed_{Leg} - Float_{Leg}(ASW_{Spd}))$$

and the ASW_{Spd} is implied into the fair value of ASW. It is obtained using a numerical method.

When the *custom bond* has a simple structure of payoff as a coupon-bearing

¹The clean price is the price of bonds listed on the market and also available on some market data provider or at all the newspapers of finance.

bond, at least with the coupons step-up or down, this structure could be used directly as a *benchmark bond*. Otherwise is necessary to consider a *benchmark bond*, if possible of the same issuer or an highly correlated, with similar maturity, or better the duration, and a simple structure of payoff (i.e. fixed rate without any options).

The ASW_{Spd} can be used as an adjustment to the payoff structure or to the discounting curve of the *custom bonds*. It is, in others words, a way to take counterpart risk into account while pricing a specific bond.²

2 How to use the plug-in

In the Fairmat user interface, in the parameters and symbols section, you'll find, under the section "Transformations", the **Asset Swap Spread Calculator**. The object allows the calculation of the Asset Swap Spread as a function of the *benchmark bond* parameters.

The Asset Swap Spread Calculator takes the following input:

- Coupon/Fixed Rate: a vector containing the coupons of *benchmark bond*. It could be constant the whole period otherwise step up or step down;
- Calendar of Bond/Fixed and Float leg : is the business day calendar of the country of issue;
- Unadjusted payment dates of Bond/Fixed leg : payment dates of *benchmark bond* or fixed leg unadjusted for calendar and market convention as date rolling adjustment;
- Date Rolling Convention of Bond/Fixed and Float leg : are a series of rules that indicate which date to consider when a payment date or a date used to calculate accrual interest falls into a holiday according to a business day calendar;
- Day count conventions of Bond/Fixed and Float Leg : define how many days must be considered between two coupons payment dates or from the valuation date to the next payment date (see also the difference between clean price and dirty price of a bond) to calculate the accrued interest;
- Unadjusted payment dates of float. leg : payment dates of floating leg unadjusted for calendar and market convention as date rolling adjustment;
- N. of days to subtract from reset dates : this is the number of days to subtract from the reset dates adjusted with the market convention;

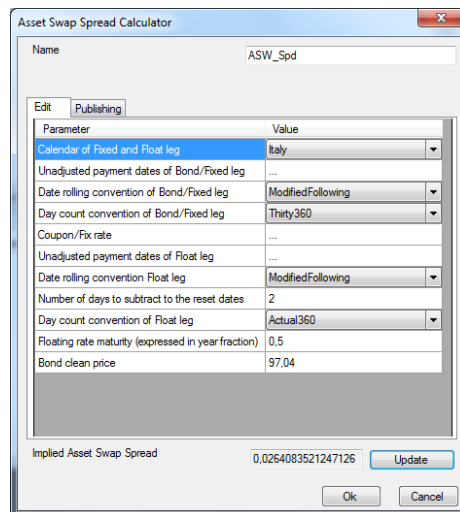
²In particular, choosing to adjust the discounting curve, you have to use the forwarding curve used to price the floating leg of ASW, incremented with the estimated ASW_{Spd} . For more information you can see also [1].

- Floating rate Maturity: the maturity, expressed in year fraction, of the floating rate (i.e. Euribor 3 m is equal to 0.25);
- Bond clean price: the price of benchmark bond quoted in the market. As usual is expressed as clean price or the price without the interest matured from the previous payment.

Although the standard maturity in which the ASW spread is expressed, in case of Eurozone, Euribor 6 m, it also can be defined for other maturities (e.g. Euribor 3m, 1m, etc. ..), regardless of the payments structure of the *benchmark bond* (e.g. annual, semi-annual etc).

Selecting the maturity of floating rate, you also choose the term which is expressed the ASW spread and the Zero Rate Curve used to calculate forward rates (forwarding curve).

The Figure 1 shows the ASW spread editing dialog window where the input defined into the previous list can be edited.



| Parameter | Value |
|---|-------------------|
| Calendar of Fixed and Float leg | Italy |
| Unadjusted payment dates of Bond/Fixed leg | ... |
| Date rolling convention of Bond/Fixed leg | ModifiedFollowing |
| Day count convention of Bond/Fixed leg | Thirty360 |
| Coupon/Fix rate | ... |
| Unadjusted payment dates of Float leg | ... |
| Date rolling convention Float leg | ModifiedFollowing |
| Number of days to subtract to the reset dates | 2 |
| Day count convention of Float leg | Actual360 |
| Floating rate maturity (expressed in year fraction) | 0.5 |
| Bond clean price | 97.04 |

Implied Asset Swap Spread: 0.0264083521247126

Figure 1: *ASW Spread Calculator inputs example.*

3 Quick example of an ASW spread estimation

In order to estimate the ASW spread, a quoted bond on a given market (*benchmark bond*) must be chosen.

In the case in which the *custom bond* structure is simple, it coincides with the *benchmark bond* and the evaluation of spread is straightforward.

When the *custom bond* is an OTC bond and-or a structured bond must be choose a *benchmark bond*. First of all the choice have to fall on an issued bond

of the same entity with same maturity or duration. Alternatively, must fall on a company owned or highly related to the issuer.

In example, consider a quoted bond issued by an Italian entity, five years maturity, with coupons that depends on the a certain level of the performance of a stock market index; in other terms a series of options. Assuming that the issuer is a company owned by the Italian state, the choice of *benchmark bond* fall in a BTP with approximately duration of five years.

If doesn't exist a bond with a similar duration, is possible to select 2 bond with duration or maturity little lower and little greater than the custom bond. After allocated every inputs, defined into the section 2, selected update, the ASW spread with the market data of the date when evaluation is run.

In case in which the *benchmark bond* are two, a hypothetical way could be, estimated both spread and after interpolate the values at expiration date of all three bonds.

References

- [1] Marco Bianchetti. Two curves, one price: Pricing and hedging interest rate derivatives decoupling forwarding and discounting yield curves. *Risk Magazine*, 2010.