# Principal Protected Note Analytics

A principal protected deposit note consists of zero plus call option and linear amortizing bond floor structure. these models are essentially accrual models, determining the current value of the option due to fee accrual and historical hedge fund performance in accordance with the documentation.

They are not forward-looking, that is, the do not attempt to value the present value of future fee income, nor do they attempt account for uncertainties in hedge fund redemption.

*Zero Plus Call* is a CAD denominated principal protected note ($100CDN per note), referencing a basked of USD hedge fund investments. The notes are lodged in the Canadian Depository for Securities Ltd., and ultimately marketed to smaller investors.

The value of the note to the investor (the 'note value') has an ultimate floor of the current price of a (CAD) zero coupon bond maturing at the maturity of the option, providing principal protection. The valuation of this structure essentially reduces to the valuation of the Zero plus a leveraged investment in an accreting strike option.

Initially the $100CAD investment is split up into the price of a CAD zero coupon bond Z0 maturing at T (option maturity), and the remainder:

$$OV(CAD) = \$100 - Z0,$$

which is the initial option value in CAD. The USD/CAD exchange rate F0 _ 1.35 is used to find the USD option value OV(USD) = OV(CAD)/F0, and the target leverage ratio L0 ~ 3.5 (discussed below) to determine the initial notional N0 of the basket and the initial strike K0:

$$N0 = L0 \times OV(USD), \quad K0 = N0 - OV(USD).$$

Since Z0 purchases the zero, the seller must put up K0 when the deal is initiated to fund the notional investment in a basket of hedge funds.

To hedge CAD/USD exchange rates, the reference basket will contain not only hedge funds, but also a foreign-exchange hedge (buy CAD, sell USD forward), the value of which depends on changes in interest and exchange rates. So at any time, the total basket value is the sum of the two components:

BV = FXHedge + HFI,

with BV0 = N0 initially. Every month-end, the value of the Hedge fund component (HFI) of the basket is derived from the value of the underlying hedge funds, and the hedge (FXHedge) and zero (Z) revalued based on the then current market conditions. All fees and valuations are based upon these quantities as of month-end.

To simplify matters somewhat, we will consider all quantities here as 'per-note', rather than keeping track of how many notes there are outstanding. Making the translation to compare with AAG reports is straightforward.

The Principal Protection Fee is charged against the Capital Basis at previous month-end (CB):

$$\mathrm{AddCapExpense} = S_a \frac{\mathrm{actual}}{360} \mathrm{AddCapBal}_{t-1}$$

where the principal protection spread is Spp ~ 1.3%. The Capital Basis is equal to the notional amount: CB = N0 until a re-/de-leveraging occurs, after which it is the lesser of the new notional amount and the original notional amount. Following such a re-/de-leveraging, there will be a net Additional Capital Balance (from additional investor contributions or hedge fund redemption), on which the Additional Capital Expense will be charged:

$$\mathrm{AddCapExpense} = S_a \frac{\mathrm{actual}}{360} \mathrm{AddCapBal}_{t-1}$$

where Sa ~ 0.9% is the additional capital balance fee.

The Call Option fee:

$$\text{COFee} = L_{t-1}\frac{\text{actual}}{360}K_{t-1} + S_p\frac{\text{actual}}{360}\Delta K_{t-1}$$

where the Lt−1 (Libor at previous month-end) is charged against the previous month-end strike price Kt−1, and the spread Sp ~ 1.3% is charged against the cumulative strike adjustment to date:

$$\Delta K_{t-1} = K_{t-1} - K_0.$$

In the first 5 years a Recovery Fee is charged:

$$\text{RecoveryFee} = \frac{S_r}{12}\$100\text{CAD},$$

where Sr _ 0.95%, and note that this fee is the single CAD denominated fee, the remainder being charged against USD quantities.

During the first year there is a setup-fee SetUpFee equal to a pre-specified amount per month, divided equally among all notes sold (that is, it is a transaction-level setup fee rather than a note-level fee). Finally there is a monthly basket Management Fee:

$$\text{ManagementFee} = \frac{S_m}{12}\text{BV}_{t-1},$$

where Sm ~ 1% is the (annualized) fee charged against the current basket value.

*Linear Amortizing bond Floor* is similar to the 'Zero plus Call' structure in that there is principal protection and there are options embedded in the Basket, however, in this case the 'bond floor' accretes linearly in time, and there is no clean interpretation of the option as in investment in a zero coupon bond with a leveraged call option.

At initiation of the deal the client invests an amount BV0 _ $10M, part of which is invested in hedge funds (HFI) and the rest in a hedge for the Bond Floor (BFHedge). At any time there may also be a cash component C.

The bond floor is initially set at some fraction above the price of a Zero coupon bond maturing at option maturity:

$$\mathrm{BF}_0 = Z_0 + x\,\mathrm{BV}_0,$$

with x ~ 3%. (In fact, x is chosen so that the Leverage Ratio, below, is set equal to a target leverage ration of ~ 3.72.) At the end of every month (n) thereafter the bond floor accretes a constant amount every month (t is an integer representing the number of months since the starting date):

$$\mathrm{BF}_t = \mathrm{BF}_0 + t\Delta\mathrm{BF}, \quad \Delta\mathrm{BF} = \frac{\mathrm{BV}_0 - \mathrm{BF}_0}{12\,T},$$

where T is the number of years to maturity. The Capital Basis CBt at every month-end is capped at BV0, but can be less due to capital contributions/withdrawals that occur during the life of the deal: If there are no capital contributions/withdrawals then CBt = CBt−1, if the are then CBt = HFIt + BFHedget. Every month a Principal Protection Fee is charged against the capital basis:

$$\mathrm{PrinProtFee} = S_{pp}\frac{\mathrm{actual}}{360}\mathrm{CB}_t,$$

Reference:

https://finpricing.com/lib/EqBarrier.html