Accrual range floating rate note

Accrual range floating rate note is a fixed income structured product that pays a coupon whose amount depends on the number of time a specified floating rate stays within a certain range during a specific period of time. In this note, the coupon is determined largely or entirely by an embedded range accumulation option, hence the name.

Index range notes are used primarily to enhance interest rate yields when an investor has confidence in a forecast. LIBOR Range Notes are the most common variety. The investor receives an above market rates coupon to compensate for him selling an embedded corridor option.

It is interesting to know that although developed for the interest rates derivatives market, the range accrual range note can also used equity stock indexes, currency exchange rates and interest rates (like swap rates or treasury yield) as the underlying for the range accumulation option.

Accrual range floating rate note are also called accretion bond index range note, corridor bond or note, range floater, range accrual note, accrual note, LIBOR range note, range accumulation note, Boost, EARN option, and fairway bond and hamster option.

The last four non-explicit and partially funny names come from bankers' interpretation and imagination and emphasise important aspect of this option.

Boost option stands for banking on overall stability (Boost) as at the start of the option, the LIBOR rate is in most structures within the range of the option and hence the option will payoff if the LIBOR remains pretty much in the same range. Stability of the LIBOR is very favourable to this option. EARN underlines the higher returns as it stands for Expected to Accrue Return on Nominal (EARN). The name of fairway option comes from the analogy with a golf ball staying on the fairway. The option accrues interest if and only if the index rate stays within a range. The last name is less poetic and is a creation of SBC marketers. Contrary to the intuition, it is not referring to the name of the small rodent, but rather to an acronym standing for Hoffnung Auf MarktStabilitaet in Einer Range (literally: Hope on market stability in a given range).

In a typical accrual range floating rate note, the issuer pays semi-annually, a structured coupon, computed as the 6-month Libor +125 basis points times the number of days that the EUR-LIBOR stays between 2.5% and 6.5% divided by the total number of days of the accreting period. For any day on which LIBOR is outside the range, the bond accrues at 0 percent. Accreting periods are the six months periods between the reset dates of a strip of date, using modified following convention, actual/360 for the day count fraction and the holiday TARGET. At maturity, it pays back 100% the notional. Often the range and the spread over LIBOR (here 125 bps) are computed such that the bond is at par. Therefore an investor who wants a strategy with a certain carry or pick-up, (here 125 bps) may be interested in investing in a range accumulation bond. Investors are like for many other structures playing the

game of increasing their risk to get higher returns. If their forecast were right, their strategy would turn out to be very profitable while the opposite is true. Obviously, investors don't expect short-term rates be outside the range. However, along with the level of LIBOR, investors must keep a watchful eye on volatility levels, because a combination of increasing rates and increasing volatility levels may have significant impact on the security's market price.

The art of the structuring group of a bank is precisely to come up with a security design where the investor is ready to take some appropriate risk to enhance its returns. *(see principles of risk-return securities design)*

Underlying the range accumulation bond is the range accreting option that holds most of the risk. Because investors of the note only received a portion of the coupon if and only if the LIBOR rate is within the range, they bear a certain risk of getting nothing and hence are rewarded for this risk.

The range accumulation option (or warrant in certain structures) can be seen as a series of binary options with each option covering a short period, typically one-day or one week. The payoff of the range accumulation option is the sum of the payoffs of the component binary options.

Denoting by F the fixed rate (in our previous example the LIBOR that have already reset plus a spread of 125 bps), and by L the lower bound of the range and by U the upper bound of the range, and by S_{T_i} the underlying

asset price at time T_i, the payoff of the range accrual coupon is given by equation (1)

$$F * \frac{\sum_{i=1..N} 1_{[L<S_{T_i}<U]}}{N} \tag{1}$$

Where the rate F is the LIBOR that have reset in advance plus a spread

$$F = \left(Lib\left(T_0, T_0 + \Delta\right) + s\right) \tag{2}$$

It is easy to see that this option can be expressed in terms of simpler option which payoff are $1_{[L<S_{T_i}<U]}$, which in turns can be decomposed in simpler options $1_{[L<S_{T_i}]} - 1_{[S_{T_i}<U]}$ called binary options (*see Binary (digital) options and Binary choice modelling*).

The individual binary options payoff when the underlying price or rate is above or below a certain strike. For hedging purposes, range notes bear similar problem as binary options. Range notes are very sensitive to the product of the slope of the smile (at the barrier level) and the vega. An intuitive explanation is to approximate the binary option by a call spread. Obviously, the payoff of a binary option is just the limiting case of a call spread:

$$1_{\{S_T>K\}} = \lim_{\varepsilon \to 0} \frac{\left(S_T - K + \varepsilon\right)^+ - \left(S_T - K - \varepsilon\right)^+}{2\varepsilon} \tag{3}$$

Therefore, writing that call option prices are function of the strike, the maturity, and the implied volatility itself function of the maturity and strike $C\left(T, K, \sigma\left(T, K\right)\right)$, we have that the price of a binary should be equal to the limit of the call spread

$$Bin = \lim_{\varepsilon \to 0} \frac{C(T, K+\varepsilon, \sigma(T, K+\varepsilon)) - C(T, K+\varepsilon, \sigma(T, K-\varepsilon))}{2\varepsilon} \quad (4)$$

Or using the chain rule

$$Bin = \frac{\partial}{\partial K} C(T, K, \sigma(T, K)) + \frac{\partial}{\partial \sigma} C(T, K, \sigma(T, K)) \frac{\partial \sigma(T, K)}{\partial K} \quad (5)$$

Proper modelling of the volatility smile is therefore essential *(see Volatility skews and smiles).*

When the range note concerns underlying that are not LIBOR, the structuring is slightly different. For instance, the customer specifies a currency range over a fixed period. A premium is paid up-front and provided that the spot stays within the range (as monitored on a 24-hour basis), then a multiple of the premium invested will be payable.

A rebate range binary is one in which the premium invested is rebated if a designated boundary of the range is breached first. A similar structure, the limit binary, is also essentially for trading. This is fundamentally a bet on a spot not staying within a predetermined range. The customer specifies two spot rates, one above and one below the current spot rate. A premium is paid upfront, and providing that both levels trade (as monitored on a 24-hour basis), a fixed multiple of the premium invested will be payable.

Last but not least, in order to have access to the structured note market, type STNT <Go> on a Bloomberg terminal. This will show you a complete report for structured notes, which details the issuance statistics and market news for both the U.S. and international structured-note markets.

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[1] The views and opininons expressed herein are the ones of the author's and do not necessarily reflect those of Goldman Sachs