Reverse Convertible Bond Analytics

A reverse convertible bond is a structure note with an embedded put option that allows the issuer to purchase the note back for a predetermined quantity of cash, debt, or stock. The decision to exercise the option is made based on the performance of an underlying asset, index, or basket of assets.

The payoff from a simple reverse convertible is defined with respect to the put option strike price and knock-in barrier level.

At reset dates before maturity, the bond will be called (and terminated) if the stock price is above *Upper Price Threshold*. Once the bond is called the investor will receive *Call Amount* plus coupon.

At maturity, if the bond had not been called, and the stock price ever touched or gone below the *Lower Price Threshold*, the payoff at maturity is notional amount minus put (down-and-in put) plus coupon.

$$N + C - N \cdot \left(\frac{K - S_T}{K} \right)^+$$

If the stock price stays above *Lower Price Threshold* during the whole tenor of the trade, the payoff at the maturity would be notional amount and coupon.

The coupon payment method described above corresponds to *Coupon At Termination IND* is set to *NO*. If *Coupon At Termination IND* is set to *YES*, then accumulated coupons are paid at the maturity or at termination.

If *Payout Type* is chosen to be *Share Payout*, then at maturity, if the bond has not been called, the payout will be in shares. The number of shares equals N / K .

Multiple Upper Price Thresholds are allowed. If there are n reset dates, t_1, t_2, … t_n, *Upper Price Thresholds* can be specified for each reset date t_2, … t_{n-1}. If only one *Upper Price Thresholds* is specified, it will apply to all reset dates.

The model allows the coupon to be a linear function of the stock price at coupon payment date. The coupon amount, C_i^L, at reset date t_i equals

$$C_i^L = N \cdot \Delta t_i \cdot \left(f, \alpha \cdot \frac{S_i}{K^R} - K^C \right)^+$$

As the payoff depends on *continuous* barrier, the expectation of the payoff can be calculated using a version of *conditional* Monte Carlo method. Multi-dimensional Brownian motion (multiple underlings) with continuous barrier is considered. For single asset this Brownian Bridge simulation fully eliminates pricing bias that arises in applications of discretized Monte Carlo to evaluate options with continuous barriers

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A high number of stock paths are generated to compute the payoff. All simulated payoffs are averaged and discounted in payoff currency. This method induces a statistical error which is taken care through a high number of simulations and variance reduction techniques.

Reference:
https://finpricing.com/lib/EqConvertible.html