A Note on Development

이준범 *

1 Payoff Decomposition

ELS Payoff, denoted by X is like:

$$
\begin{aligned}
X &= \sum_{i=1}^{N}\Big(\prod_{j<i}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\mathbb{1}_{S_{T_i}\geq\mathcal{R}_i}C_i + \sum_{i=1}^{L}\Big(\prod_{j<i}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\mathbb{1}_{S^*_{(T_{i-1},T_i]}\geq\mathcal{L}_i}C_i^L \\
&\quad + \Big(\prod_{j<N}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\Big(\mathbb{1}_{S^*_T<\mathcal{B}}\phi(S_T) + \mathbb{1}_{S^*_T\geq\mathcal{B}}C^B\Big) \\
&= \sum_{i=1}^{N}\Big(\prod_{j<i}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\mathbb{1}_{S_{T_i}\geq\mathcal{R}_i}C_i + \sum_{i=1}^{L}\Big(\prod_{j<i}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\mathbb{1}_{S^*_{(T_{i-1},T_i]}\geq\mathcal{L}_i}C_i^L \\
&\quad + \Big(\prod_{j<N}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\Big(\phi(S_T) + \mathbb{1}_{S^*_T\geq\mathcal{B}}(C^B-\phi(S_T))\Big) \\
&= \sum_{i=1}^{N-1}\Big(\prod_{j<i}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\mathbb{1}_{S_{T_i}\geq\mathcal{R}_i}C_i + \Big(\prod_{j<N-1}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\Big(\mathbb{1}_{S_{T_N}\geq\mathcal{R}_N}C_N + \mathbb{1}_{S_{T_N}<\mathcal{R}_N}\phi(S_T)\Big) \\
&\quad + \sum_{i=1}^{L}\Big(\prod_{j<i}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\mathbb{1}_{S^*_{(T_{i-1},T_i]}\geq\mathcal{L}_i}C_i^L \\
&\quad + \Big(\prod_{j<N}\mathbb{1}_{S_{T_j}<\mathcal{R}_j}\Big)\mathbb{1}_{S^*_T\geq\mathcal{B}}(C^B-\phi(S_T))
\end{aligned}
\tag{1.1}
$$

Hence there should be $L+2$ grids: one for ranges, L for the lizard barriers, one for the maturity barrier.

2 OIS schedule

Let us denote the calculation period pair of fixing, value start, value end, payment dates by:

$$I_i = \{\phi_i, \sigma_i, \epsilon_i\}. \tag{2.1}$$

To explain the notation, we usually have $\epsilon_i - \sigma_i = \mathrm{Day}(1)$ in OIS cases. These periods comprise the swap intervals $\{(S_i, E_i]\}_i$ such that:

$$(S_N, E_N] := (\sigma_{M_i}, \epsilon_{N_i}] = \cup(\sigma_i, \epsilon_i] \tag{2.2}$$

*OTC Trading, Yuanta Securities Korea, 04538 Seoul, Korea.
Tel: +82-2-3770-5993. Email: junbeom.lee@yuantakorea.com.

Then, we have the latest past fixing data δ_t at $t \geq 0$ and the regarding value end date ϵ_d

$$t \mapsto \delta_t \mapsto \epsilon_d \tag{2.3}$$

Let $I = [a, b]$ be a calculation interval, ϕ be the fixing interval, and μ be the respective payment date. Note that ϕ may or may not be in the calculation interval, i.e., either $\phi \in [a, b]$ or $\phi \notin [a, b]$, but the payment date cannot be earlier than the end date b. Moreover, let $t \geq 0$ denote the evaluation date and $C(t, ., .)$ denote the (zero) curve given at $t \geq 0$.

Consider that there are a set of past data $d(\phi_i)$ such that $\phi_i \leq t$:

$$\{\phi_1, \phi_2, \ldots, \phi_N\}. \tag{2.4}$$

Let us denote by ε_N the calculation end date regarding the last fixing date.