**LV PDE pricing**

**Algorithm:**

1. Extreme , , , .
2. Compute uniform grids
3. Transform to non-uniform grids
4. Retireve loc vol is linear interpolated

Notation:

|  |  |
| --- | --- |
|  | Trade maturity |
|  | Vol maturity pillars |
|  | Time diffusion grid |
| , , , or | The option value at time step and spatial step |
|  |  |

is piecewise constant along time (always equal to the at next quoted pillar ), and linear interpolated along and flat extrapolated.

**PDE for different payoffs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Vanilla | Continuous American Barrier | Continuous Partial Barrier | Discrete Barrier | Vanilla TARF | TARF Continuous Barrier |
| Spatial Scale |  |  |  |  |  |  |
| Spatial Discretization | Non-uniform spatial discretization | Non-uniform spatial discretization. |  |  |  |  |
| Spatial end points , | ,  . | ,  . |  |  |  |  |
| Time Scale | . | | | | | |
| Time Discretization | Non-uniform time discretization   1. Basis steps ; 2. Major steps : from vol pillar dates; 3. Implicit steps : 2 extra smaller steps for each major step will be added. | Non-uniform time discretization   1. Basis steps ; 2. Major steps : from vol pillar dates; 3. Implicit steps : 2 extra smaller steps for each major step will be added. | Non-uniform time discretization   1. Basis steps ; 2. Major steps : from vol pillar dates **and partial window start & end dates**; 3. Implicit steps : 2 extra smaller steps for each major step will be added. | Non-uniform time discretization   1. Basis steps ; 2. Major steps : from vol pillar dates **and discrete barrier dates**; 3. Implicit steps : 2 extra smaller steps for each major step will be added. | Non-uniform time discretization   1. Basis steps ; 2. Major steps : from vol pillar dates **and fixing dates**; 3. Implicit steps : 2 extra smaller steps for each major step will be added. | Non-uniform time discretization   1. Basis steps ; 2. Major steps : from vol pillar dates **and fixing dates**;   Implicit steps : 2 extra smaller steps for each major step will be added. |
| PDE Diffusion Scheme | Rannacher scheme:   1. Implicit steps use implicit scheme 2. The rest use CN scheme | | | | | |
| Spatial boundary conditions | All derivatives without continuous barrier:  Null Gamma Condition | With continuous barrier:  Dirichlet Condition   * , , if lower barrier; * , , if upper barrier. |  |  | All derivatives without continuous barrier: Null Gamma Condition |  |
| Initial Condition | Vanilla payoff at time | Barrier payoff at time | Vanilla payoff at time ;  Barrier levels checking at barrier window . |  |  |  |