Aldrin and Zeliade

**I) Lot 1, Total Return Swap:**

Object: Total Return Swap Pricer  
  
Purpose: Pricing and Hedging. The TRS pricers aim at computing the Greeks and price of total Return Swap.  
Underlying Equity forward and expected dividends are in house computed and should include repo and dividend All-in  
  
Criteria of success :   
Repricing of instrument : independent pricing should give the same results.  
Good hedging behavior : because the Pricer will be used for hedging purpose, it should output smooth Greeks in all realistic market conditions.  
  
Pricer Description:   
  
A TRS (Total Return Swap) is an instrument widely used in retail distribution networks, for private bank as well as for professional investors. A TRS is a derivatives contract where two parties exchange financials flows based on performance of financial instruments. The swap can be an exchange of:   
-Equity underlying performance VS Fixed Rate.  
-Equity underlying performance VS interest Rate floating Index (Euribor, Eonia, CMS..).  
-Equity underlying performance VS Equity underlying performance.

-Equity underlying performance VS Bond underlying performance (light model for the bond).

Input List:

|  |  |
| --- | --- |
| Category | Data Description |
| Market Data | Underlying 1 |
| Market Data | Underlying 2 |
| Market Data | FX Rates (when applicable) |
| Market Data | Interest Rates |
| Market Data | Basket Weights |
| Pricing Parameters | As of Date |
| Pricing Parameters | Start Date |
| Pricing Parameters | End Date |
| Pricing Parameters | Equity Leg Type (Fixed or Floating Asset) |
| Pricing Parameters | Leg 1 schedule (Fixing and Payment) |
| Pricing Parameters | Leg 2 schedule (Fixing and Payment) |
| Pricing Parameters | Dividend Ratio |
| Pricing Parameters | Payment Currency |
| Pricing Parameters | Notional |

Outputs:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Indicators | Bumped Parameters | Method | Bump | Normalization |
| Equity Delta | Equity Spot | Relative symmetric finite difference + PSG | 1% | Divide by the choc in % of the spot |
| Repo | Repo Curve | Absolute asymmetric finite difference | 0,01% |  |
| Epsilon | Unknow Dividend | Absolute asymmetric finite difference (Gross Dividende Without All-In) | 1% |  |
| IR Delta | IR Curve | Absolute asymmetric finite difference (parallel ) | 0.01% | 1% normalization |
| Fx Delta | FX Spot | Relative either symmetric or asymmetric, finite difference | 1% | 0.01 normalization if symmetric |
| AI Delta | AI Parameters | Absolute asymmetric finite difference | 1% |  |

Formula:   
  
Mathematical Description :

Swap Pay Off

With

=-1,1 if receive or paid

the payoff of the performance of the leg at time t

the payoff of the dividend of the leg at time t

the payoff of the rate of the leg at time t

*Performance Leg :*

*Dividend Leg :*

*Rate Leg :*   
a) Floating Rate :

b) Fixed Rate:

Forward:

Underlying Equity forward and expected dividends are in house computed and should include repo and dividend All-in

*Formula:*

Where:

*For Dividends Expectations:*

For Dividend expectations we can define 2 periods: the short-term side (Maturity inferior at 6 Months) and the Long-term side (Maturity Superior at 6 months).  
Both term should match the implied dividends from the dividend Swap.  
  
-On the short-term Side we can have a good estimate of expected Dividends, the table should like:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ticker** | **Ex-Date** | **Pay-Date** | **Amount Bid** | **Amount Ask** | **Currency** | **Status** | **Ai Bid** | **Ai Ask** |
| FP FP | 21/06/2020 | 23/06/2020 | 3 | 3.2 | EUR | Confirmed | 88% | 90% |
| CS FP | 25/06/2020 | 30/06/2020 | 0.83 | 0.85 | EUR | Expected | 88% | 90% |
| EI GY | 28/07/2020 | 05/08/2020 | 2 | 2 | USD | Confirmed | 92% | 95% |

-On the long-term side, we do not have a good estimate of expected dividends, so we can only use the Dividend Swap, it implied we do not have a calendar of expected dividend payment but only an expected total Amount paid.   
  
Note: the first dividend swap used for the long-term part should be amend to take into account the Short term expected dividend and dividend already paid if applicable.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ticker** | **Bid** | **Ask** | **Mid** | **Expiry Date** |
| **DEDZ0** | 86,9 | 87 | 86,95 | 18.12.2020 |
| **DEDZ1** | 84,1 | 84,2 | 84,15 | 17.12.2021 |
| **DEDZ2** | 95,1 | 95,2 | 95,15 | 16.12.2022 |
| **DEDZ3** | 98,4 | 98,5 | 98,45 | 15.12.2023 |
| **DEDZ4** | 97,4 | 97,5 | 97,45 | 20.12.2024 |
| **DEDZ5** | 95,7 | 95,9 | 95,8 | 19.12.2025 |
| **DEDZ6** | 93,4 | 93,6 | 93,5 | 18.12.2026 |
| **DEDZ7** | 90 | 90,8 | 90,4 | 17.12.2027 |
| **DEDZ8** | 87,7 | 88,1 | 87,9 | 15.12.2028 |

However, we can imply a calendar of expected payment from the historical payment timeline of dividend:

For the long term All-in, we should use a long-term value with a decreasing growth rate.

*For Repo-Rate:*

Repo-Rate are expressed versus a Rate-Curve (Usually Eonia or Euribor),  
On the Short Terme side we use Exchange for Physical and Roll to determine a Repo Rate

On the long Terme Side we used Synthetic Future to determine a Repo-Rate

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Expiry Date** | **Nd Day** | **Repo Rate VS Eonia bid** |  | **Repo Rate VS Eonia ask** | **From** |
| 19.06.2020 | 13,0 | 0,62% |  | 0,63% | EFP |
| 18.09.2020 | 104,0 | 0,08% |  | 0,09% | EFP + Roll |
| 18.12.2020 | 195,0 | 0,00% |  | 0,01% | Synthe |
| 17.12.2021 | 559,0 | -0,11% |  | -0,10% | Synthe |
| 16.12.2022 | 923,0 | -0,17% |  | -0,16% | Synthe |
| 15.12.2023 | 1 287,0 | -0,22% |  | -0,21% | Synthe |
| 20.12.2024 | 1 658,0 | -0,27% |  | -0,26% | Synthe |
| 19.12.2025 | 2 022,0 | -0,33% |  | -0,32% | Synthe |
| 18.12.2026 | 2 386,0 | -0,40% |  | -0,39% | Synthe |
| 17.12.2027 | 2 750,0 | -0,46% |  | -0,45% | Synthe |
| 15.12.2028 | 3 114,0 | -0,52% |  | -0,51% | Synthe |

Collateralization Scheme:   
  
We should assume there is 3 main collateralization Schemes:   
-Cash: in EUR, USD, CHF, JPY and GBP. We assume that we are under a CSA Agreement. So, each curve should be OIS discounting one (Eonia for EUR, Fed fund for USD.)

-No collateral: The discounting curve should be the one in relationship with the Equity Leg Schedule (Euribor 3M in case of a quarterly schedule, Euribor 6 Month in case of a semesterly schedule) with a Credit-Risk Spread and a Cross-Currency Basis swap if applicable.   
-Securities Collateral: the discounting curve should be the repo curve of the security used as collateral (for example SX5E Repo curve for a basket of EUR stock), it should include cross-currency basis swap if applicable.   
  
We expect an error message if the curve is not correctly set-up.

Additional Features:

*-Equity Total Return Swap with Fixed Notional*: in this feature, the notional of the Equity Leg is expected to be constant through the life of the TRS. If the notional value of the swap falls below a certain amount, the counterparty of the swap is expected to buy more shares to keep the Notional of the Equity leg constant. Thus, impacting the cost of financing of the swap. The 2 main drivers for this feature is the Amount threshold (An Amount from which the notional of the swap can’t deviate) and the Periodicity (A Schedule on which the TRS notional is expected to be reset to match the initial Nominal).  
A Monte Carlo simulation of the path of the TRS and therefore the cost associate with this feature is expected.

*-Reset of the Total Return Swap : The* Equity Notional Reset is a feature for automatically restriking the [Equity Notional Amount](https://jollycontrarian.com/index.php?title=Equity_Notional_Amount_-_Equity_Derivatives_Provision" \o "Equity Notional Amount - Equity Derivatives Provision) on a periodic basis to its prevailing value. If the Marked to Market of the Swap falls below a predefined level, we restrike the trade at the market value, and pay out the difference in the value of the underlier over the reset period.

Thus, impacting the cost of financing of the swap.  
The 2 main drivers for this feature is the Amount threshold (A mark to market limit triggering a reset of the swap) and the Periodicity (A Schedule on which the TRS is expected to be reset).  
A Monte Carlo simulation of the path of the TRS and therefore the cost associate with this feature is expected.

**II) Lot 2, Autocallable TRS, Dividend Swap, Upgrade of the Bon model:**  
To be Defined

* Hybrid model integration (rate correlation to be ingrated)
* Bond model
* Dividend swap