Multi-Asset Equity-Linked Notes

- The par value of this 2-year note is D. It has 12 coupon dates, E_1, E_2,…..$E_{12,}$ and can be called back, depending on the values of two assets S_j^1 and S_j^2 where j is a point in time

- Each coupon period is 2-month long and begins at B_i, i=1,…,12. Both B_i and E_i are measured in number of trading days with B_1 = 1

- The full coupon amount D * F is paid in the first coupon period. F is the coupon rate per period.

Definition

- The note is called (and the contract ended) if, at E_1 or any other day k before maturity, each asset price S_k^j , j=1,2, is greater than or equal to its callable price C S_0^j , where C is a given call factor

- For each coupon period x after the first, only a fraction $\frac{n_x}{N_x}$ of the coupon D * F is paid either at the end of the period or at call date, whichever comes first. N_x is the number of business days in the period and n_x is the number of business days when the closing prices of both shares S_k^j , j=1,2, are greater than or equal to their low-range values K S_0^j where K is a given factor

- At call date, the holder receives par value D and the coupon $\frac{n_x}{N_x}$ * D * F where x is the period the call occurs

- At maturity, if each share price $S_{E_{12}}^j$ is greater than K S_0^j, the holder receives D. Otherwise, she receives

$$\min\{\frac{D}{\mathrm{K}\ S_0^1} S_{E_{12}}^1 , \frac{D}{\mathrm{K}\ S_0^2} S_{E_{12}}^2 \}$$

- At maturity, the holder receives also the coupon

$$\frac{n_{E_{12}}}{N_{E_{12}}} * \mathrm{D} * \mathrm{F}$$

- Write an application that accepts the inputs shown below and estimates the fair value of the note

Assignment

Multi_Assets_RAN.xls [Compatibility Mode] - Microsoft Excel non-commercial u

D16

	A	B	C	D	E	F	G	H	I	J
1	(on 20 Sep 2007)	Asset I	Asset II		Correlation Matrix			Period	Start Date	End Date
2	Initial Stock Price (S0)	18.4	7.8		1	0.3907		1	9/21/2007	11/20/2007
3	Risk Free Rate (rf)	0.046			0.3907	1		2	11/21/2007	1/21/2008
4	Dividend yield (q)	0.0005	0.0232					3	1/22/2008	3/20/2008
5	Volatility (σ)	0.4433	0.6043					4	3/21/2008	5/20/2008
6	Time to Maturity (T)	2						5	5/21/2008	7/21/2008
7	Time step (dt)	0.004057						6	7/22/2008	9/22/2008
8	Number of steps (m)	493						7	9/23/2008	11/20/2008
9	Number of Path (n)	30000						8	11/21/2008	1/20/2009
10	Note Denomination(D)	50000			Run			9	1/21/2009	3/20/2009
11	Accrual Factor (F)	5.67%						10	3/21/2009	5/20/2009
12	Lower Range Band (K)	0.8						11	5/21/2009	7/20/2009
13	Callable Price (C)	0.92						12	7/21/2009	9/21/2009
14	Correlation (ρ)	0.3907								
15										
16	Simulated price	47593.75								

Note

- To generate the correlated asset paths, use the BS_Cpath function previously provided in the library

Algorithm

(1) Set Coupon = $e^{-rE_1\Delta t}DF$

(2) Set $S_{E_1}^{*} = min\left\{\frac{S_{E_1}^{1}}{S_0^{1}}, \frac{S_{E_1}^{2}}{S_0^{2}}\right\}$

(3) If $S_{E_1}^{*} \geq C$, then set P = $e^{-rE_1\Delta t}D$ and go to step 14, otherwise continue

(4) Set i = E_1 + 1 and x = 2

(5) Set $S_i^{*} = min\left\{\frac{S_i^{1}}{S_0^{1}}, \frac{S_i^{2}}{S_0^{2}}\right\}$

(6) If S_i^{*} ≥ K, then set n_x = n_x + 1

(7) If $S_i^* \geq$ C, then set Coupon = Coupon + $e^{-ri\Delta t}\frac{n_x}{E_x - E_{x-1}}DF$ and P = $e^{-ri\Delta t}D$ and go to step 14. Otherwise, continue.

(8) If i = E_x, then set Coupon = Coupon + $e^{-rE_x\Delta t}\frac{n_x}{E_x - E_{x-1}}DF$ and x = x + 1

(9) Set i = i + 1 and repeat steps (5) through (8) until i = E_{12}. Do not go through these steps if i = E_{12}.

(10) Set $S_{E_1}^* = min\left\{\frac{S_{E_1}^1}{S_0^1}, \frac{S_{E_1}^2}{S_0^2}\right\}$

(11) If $S^*_{E_{12}} \geq$ K, then set $n_{12} = n_{12} + 1$

(12) Set Coupon = Coupon + $e^{-rE_{12}\Delta t} \frac{n_{12}}{E_{12}-E_{11}} DF$

(13) Set P = $e^{-rE_{12}\Delta t} D$ min$\left\{\frac{S^*_{E_{12}}}{K}, 1\right\}$

(14) Price = P + Coupon