$$S_2 \left[D(0,T_1) P(T_1) \Delta t_1 + D(0,T_2) P(T_2) \Delta t_2 \right] = \underbrace{(1-R)}_{L} \left[D(0,T_1) \left(P(T_0)^{1} - P(T_1) \right) \right.$$

$$\left. + D(0,T_2) \left(P(T_1) - P(T_2) \right) \right.$$

$$S_2 D(0,T_1) P(T_1) \Delta t_1 + S_2 D(0,T_2) P(T_2) \Delta t_2 = L D(0,T_1) \left(1 - P(T_1) \right) + L D(0,T_2) \times$$

$$\left(P(T_1) - P(T_2) \right)$$

$$S_2 D(0,T_1) P(T_1) \Delta t_1 + S_2 D(0,T_2) \underline{P(T_2)} \Delta t_2 = L D(0,T_1) - L D(0,T_1) P(T_1)$$

$$+ L D(0,T_2) P(T_1)$$

$$- L D(0,T_2) \underline{P(T_2)}$$

$$S_2 D(0,T_2) P(T_2) \Delta t_2 + L D(0,T_2) P(T_2) = L D(0,T_1) - L D(0,T_1) P(T_1)$$

$$+ L D(0,T_2) P(T_1)$$

$$- S_2 D(0,T_1) P(T_1) \Delta t_1$$

$$P(T_2) \left[S_2 D(0,T_2) \Delta t_2 + L D(0,T_2) \right] = \cdots$$

$$\textcircled{4}$$

$$P(T_2)\left[D(0,T_2)\left(S_2\Delta t_2 + L\right)\right] = D(0,T_1)\left(L - LP(T_1) - S_2 P(T_1)\Delta t_1\right)$$
$$+ D(0,T_2) L P(T_1)$$

$$P(T_2)\left[D(0,T_2)\left(S_2\Delta t_2 + L\right)\right] = D(0,T_1)\left[L - P(T_1)\left(L + S_2\Delta t_1\right)\right]$$
$$+ D(0,T_2) L P(T_1)$$

$$P(T_2) = \frac{D(0,T_1)\left[L - P(T_1)\left(L + S_2\Delta t_1\right)\right]}{D(0,T_2)\left(S_2\Delta t_2 + L\right)} + \frac{\cancel{D(0,T_2)} L P(T_1)}{\cancel{D(0,T_2)}\left(S_2\Delta t_2 + L\right)}$$

$$P(T_2) = \frac{D(0,T_1)\left[L - P(T_1)\left(L + S_2\Delta t_1\right)\right]}{D(0,T_2)\left(L + S_2\Delta t_2\right)} + \frac{P(T_1) L}{L + S_2\Delta t_2}$$

⑤

$$N = 3$$

$$P(T_N) = \frac{\sum_{n=1}^{N-1} D(0,T_n)\left[L\,P(T_{n-1}) - (L+\Delta t_n\, S_N)\,P(T_n)\right]}{D(0,T_N)(L+\Delta t_n\, S_N)} + \frac{P(T_{N-1})\,L}{(L+\Delta t_N\, S_N)}$$

$$P(T_3) = \frac{\sum_{n=1}^{2} D(0,T_n)\left[L\,P(T_{n-1}) - (L+\Delta t_n\, S_3)\,P(T_n)\right]}{D(0,T_3)(L+\Delta t_n\, S_3)} + \frac{P(T_2)\,L}{(L+\Delta t_3\, S_3)}$$

Note: The bootstrapping formulas above are implemented in the XLS file:

ImprovedBootstrappingExample.xls

6

Recovery Rate	50%

$$N = 1$$

$$P(T_1) = \frac{L}{s_1 \Delta t_1 + L}$$

TIME (Years)	dt	MARKET SPREAD	DF	IMPLIED SURVIVAL PROB	first term	second term	third term	fourth term	sum	quotient	first term	last term
0				100.00%								
1	1	29.00	0.9803	99.42%								
2	1	39.00	0.9514	98.45%	- 0.0010				- 0.0010	0.4794	- 0.0020	0.9865
3	1	46.00	0.9159	97.26%	- 0.0017	0.0003			- 0.0013	0.4622	- 0.0029	0.9755
4	1	52.00	0.8756	95.88%	- 0.0022	- 0.0002	0.0008		- 0.0017	0.4424	- 0.0038	0.9626
5	1	57.00	0.8328	94.37%	- 0.0027	- 0.0007	0.0004	0.0013	- 0.0018	0.4211	- 0.0043	0.9480

$$N = 5$$

$$P(T_5) = \sum_{n=1}^{4} \left(\blacksquare + \blacksquare + \blacksquare + \blacksquare \right) + \frac{P(T_4) L}{L + \Delta t_5 S_5}$$

$\blacksquare$