Coursework 1
Structured Credits & Equity Product

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Problem 1

(a) For each point on the CDS curve, the CDS upfront (in % of notional) that would be payable by the buyer of protection is shown in the Table 1(a).
The upfront can be calculated based on the formula given in the lecture slides, detailed calculation can be found in the Excel attachment.

Maturity	Spread	Upfront
1	30	-0,6896%
2	50	-0,9729%
3	70	-0,8619%
4	90	-0,3759%
5	110	0,4595%
6	120	1,0812%
7	130	1,8525%
8	140	2,7596%
9	150	3,7882%
10	160	4,9234%

Table 1(a).

(b) Calculate the risky duration for each point on the CDS curve
For Fixed Coupon + Upfront trades, the Risky Duration is just equal to the difference in upfronts for a 1bp change in spread. The results can be seen in the below Table 1(b).

Maturity	Spread+1bp	Upfront	Spread	Upfront	Risk Duration
1	31	-0,6796%	30	-0,6896%	0,000100
2	51	-0,9532%	50	-0,9729%	0,000197
3	71	-0,8329%	70	-0,8619%	0,000290
4	91	-0,3381%	90	-0,3759%	0,000377
5	111	0,5052%	110	0,4595%	0,000457
6	121	1,1346%	120	1,0812%	0,000534
7	131	1,9130%	130	1,8525%	0,000605
8	141	2,8265%	140	2,7596%	0,000669
9	151	3,8608%	150	3,7882%	0,000726
10	161	5,0011%	160	4,9234%	0,000776

Table 1(b).

(c) Calculate the Carry, Excess Carry, Slide and Time Value of a 5s10s duration weighted steepener over a one-year horizon. The notional of the 5y leg is €10,000,000.

Due to it is a 5s10s steepener, we assume to buy €10,000,000 of 10y protection and selling €10,000,000 of 5y protection. Every year we will receive a coupon of 100bp. Carry over next 12m = Fixed Coupon = 1.00%. When we initially sell protection, the upfront is equal to:
5y Upfront = 5y Risky Annuity x (5y Spread – Coupon) = 0,4595%
If the spread had stayed constant at 150bp, the upfront would still have changed due to the shorter maturity. the new 4y Upfront changes to 0,3727%
We know from the table before that the 4y risky annuity would be equal to 3.72 if this spread had remained constant. This would have resulted in a new 4y upfront of 0,3727%. This means the upfront would have reduced by 0.0867% even if the spread had remained constant. We call this the Excess Carry. Excess Carry over next 12m = 0.0867%.
One year later we expect the upfront we unwind the trade at to be equal to:
The slide is the change in the upfront not explained by the excess carry.
Slide over next 12m = 5y Upfront – 4y Upfront – Excess Carry = 0,0748%
Time Value = Carry + Excess Carry + Slide = 0,18%
All these number need to time notional of the 5y leg (€10,000,000). The results show in the below table 1(c).

Sell 5Y Leg			
Notional5Y	10000000		
Carry	100000		
Excess Carry	8673,87887	5y Upfront	0,45946197
Slide	74857,5843	New4y Upfront	0,37272318
Time Value	183531,463		0,08673879
Buy 10Y Leg			
Notional10Y	5887874		
Carry	58878,74		
Excess Carry	24406,8643	10y Upfront	4,92344846
Slide	42437,7327	New9y Upfront	4,50892083
Time Value	125723,337		0,41452763
Time Value	57808,1262		

Table1(c).

(d) For a fixed 5y leg notional of €10,000,000, what notional of 10y protection would result in a time value equal to zero over a one-year horizon for a 5s10s steepener trade?
A notional of 8598143,55.

Problem 2

(a) Calculate the 1Y forward spread curve for the CDS curve
In the lecture slides, we know the equation for the implied CDS forward spread purely in terms of spreads and risky annuities of conventional CDS contracts:
Si,j = (RAjSj - RAiSi)/(RAj - RAi)

The 1Y Forward Spread Curve is shown below, based on the numbers we calculate.

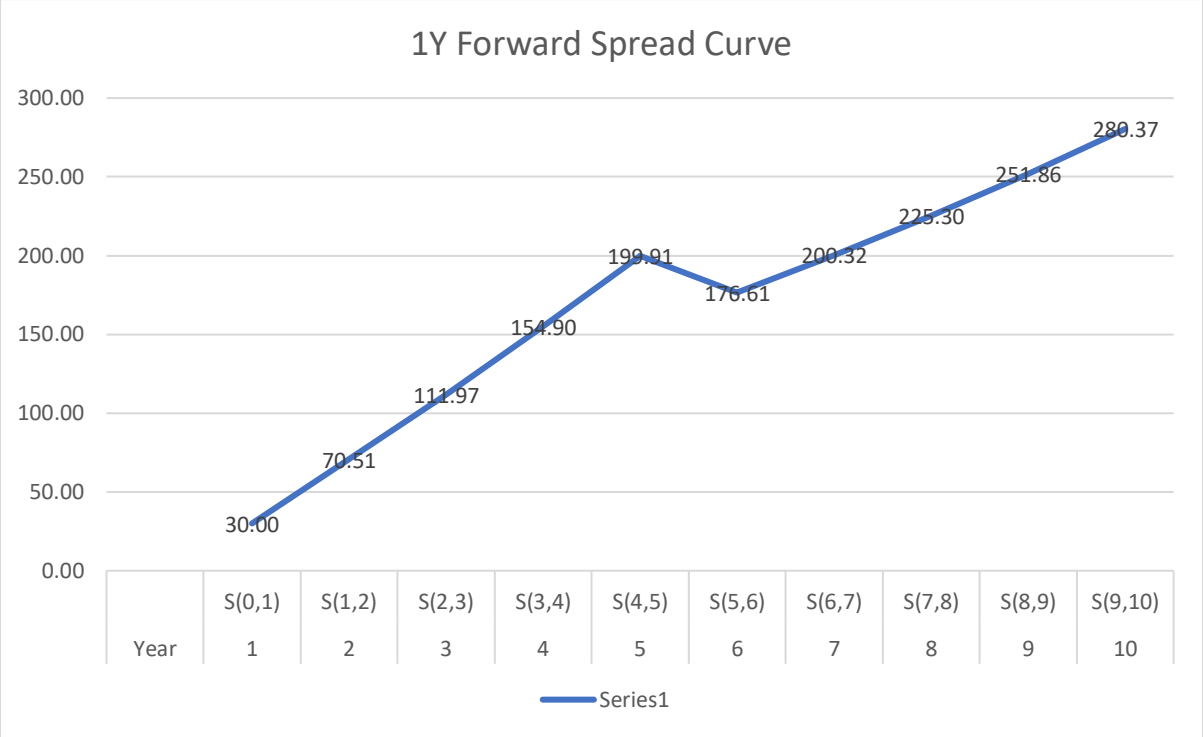


Figure 2(a).

(b) What trade would you recommend taking advantage of this discrepancy and position for the fifth year forward to tighten relative to the sixth year forward?
In the Figure 2(a), we can see there is a turning point in forward spread curve during year 5 and 6. It is a situation for steepener which means, when the forward spread goes down, the price of it also goes down in year 6. But one year after that, the price will change back to the before level of year 5. So, we should sell at a higher price level and buy in at a lower price level, namely sell 5y and buy 6y.

(c) What is the carry, excess carry, slide and time value for the trade recommended in part b) over a one-year horizon?
It is same calculation process as the question before. Each number shown in the table 2(c).

	Sell 5Y	Buy 6Y		
Notional10Y	10000000	10000000	6y Upfront	1,08124319
Carry	100000	100000	New5y Upfront	0,91434247
Excess Carry	8673,87887	16690,0719		0,16690072
Slide	74857,5843	45488,0499		
Time Value	183531,463	162178,122		
Difference	21353,3413			

Table 2(c).

Problem 3

(a) Calculate the par spread curve that corresponds to the quoted CDS curve shown in Figure 1.

As we known in the lecture, Upfront = Risk Annuity * (Par Spread - Coupon)

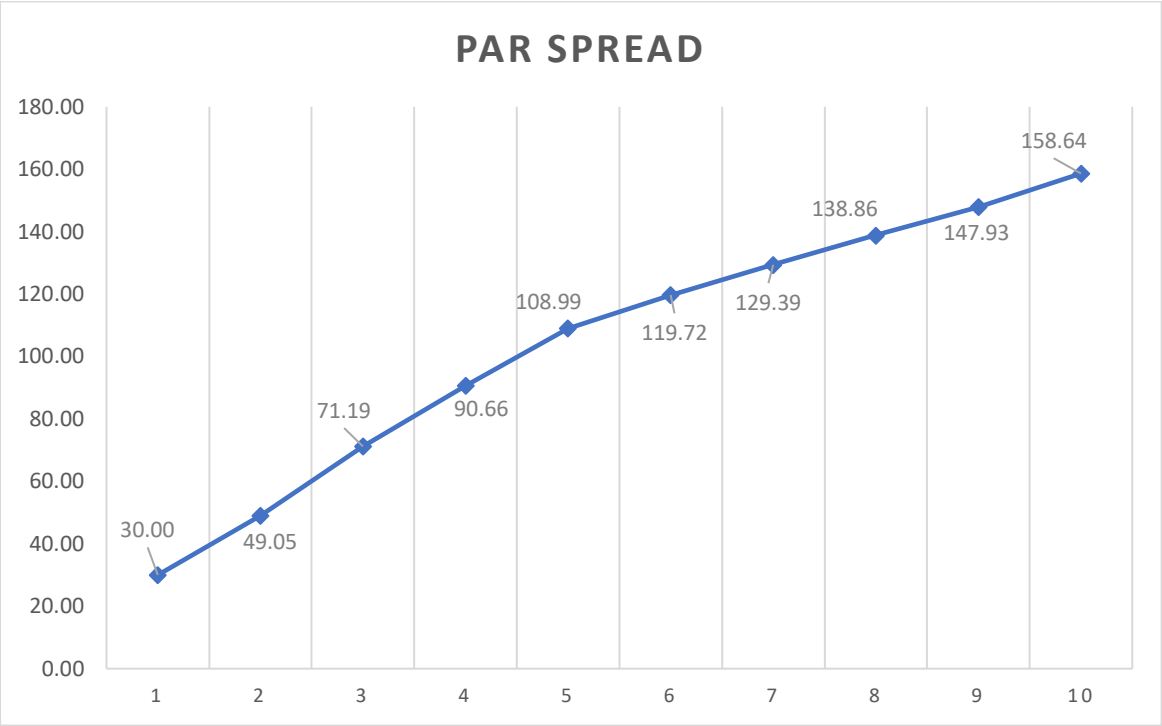
The Coupon rate still maintain 1%.

Due to the Upfront is known in the calculation before, and Risk Annuity can be explained by a form of par spread (a*spread), the variance in upfront can be explained by the changes in par spread. And if we know the upfront in target, we can solve par spread then, this all can be done in Excel I attached.

Year	Upfront (Target)	lambda	Par Spread
1	-0,006896	0,005	30,00
2	-0,0097294	0,01133861	49,05
3	-0,0086194	0,01920759	71,19
4	-0,0037585	0,02478121	90,66
5	0,00459462	0,0302859	108,99
6	0,01081243	0,02884513	119,72
7	0,01852517	0,03118675	129,39
8	0,02759597	0,03411448	138,86
9	0,03788156	0,03666647	147,93
10	0,04923448	0,0423532	158,64

Table 3(a).

The par spread curve also shows in below.


PAR SPREAD
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1
2
3
4
5
6
7
8
9
10
30.00
49.05
71.19
90.66
108.99
119.72
129.39
138.86
147.93
158.64
Figure 3(a).