

HOMEWORK

Problem 1. Consider historical data provided by rating agencies can be used to estimate the probability of default.

TABLE 1. Average Cumulative Default Rates (%), 1970–2013

Rating	1 yr	2 yr	3 yr	4 yr	5 yr	7 yr	10 yr	15 yr	20 yr
Aaa	0.000	0.013	0.013	0.037	0.104	0.241	0.489	0.910	1.073
Aa	0.022	0.068	0.136	0.260	0.410	0.682	1.017	1.871	3.167
A	0.062	0.199	0.434	0.679	0.958	1.615	2.759	4.583	7.044
Baa	0.174	0.504	0.906	1.373	1.862	2.872	4.623	8.306	11.969
Ba	1.110	3.071	5.371	7.839	10.065	13.911	19.323	28.500	35.410
B	3.904	9.274	14.723	19.509	23.869	31.774	40.560	50.275	55.892
Caa-C	15.894	27.003	35.800	42.796	48.828	56.878	66.212	73.152	74.946

- Calculate the average hazard rate for a B-rated company during the first year from the data in Table;
- Calculate the average hazard rate for a Ba-rated company during the third year from the data in Table

Problem 2. A credit default swap requires a semiannual payment at the rate of 60 basis points per year. The principal is \$300 million and the credit default swap is settled in cash. A default occurs after four years and two months, and the calculation agent estimates that the price of the cheapest deliverable bond is 40% of its face value shortly after the default. List the cash flows and their timing for the seller of the credit default swap.

Problem 3. Consider a 5-year Credit Default Swap (CDS) on a reference entity. Assume:

- Constant continuously compounding risk-free rate $r = 2\%$
- Recovery rate $R = 40\%$
- Default intensity $\lambda = 0.03$
- Premium payments are annual ($\Delta t_i = 1$)
- Assume credit events can only occur on premium payment dates.

Write explicit formulas for the present value of the premium leg and protection leg and compute the fair spread S^* (to 4 decimals).