12. Long-Term Debt. Term Structure of Interest Rates. Leasing

Problem 63

Is a bond selling at a discount or a premium if the annual coupon interest rate is 10% and the market requires a return of 8% ? How much is an investor willing to pay for this bond if it matures in 5 years ?

Solution

Bond Value   1079,9

Since the coupon rate exceeds the discount rate, the bond is priced at a premium.

1	2	3	4	5
100	100	100	100	1 100

NPV =   1 079,9

Problem 64

A bond has a par value $100 and fixed annual coupon rate 10%.
Yield to maturity is 8% and maturity is 5 years.
(a) Calculate the price of a bond at the end of t=0.
(b) Calculate the price at the end of the first year before and after interest payment.
   What is the possible range for a bond price in the first year when YTM does not change ?
c) Calculate the price of a bond 90 days later. Assume that YTM is 12% at that time.

Solution

(a)

The bond price at the end of t=0:

$$P_0 = \frac{10\% \times 100}{(1+8\%)^1} + \frac{10\% \times 100}{(1+8\%)^2} + \frac{10\% \times 100}{(1+8\%)^3} + \frac{10\% \times 100}{(1+8\%)^4} + \frac{10\% \times 100 + 100}{(1+8\%)^5} = 107,99$$

The price of a bond is equal to the sum of discounted cash flows (interests + principal repayment).

Period	1	2	3	4	5
Cash flow	10	10	10	10	110
Discounting factor	0,9259	0,8573	0,7938	0,7350	0,6806
Discounted cash flow	9,26	8,57	7,94	7,35	74,86
Cummulated cash flow	9,26	17,83	25,77	33,12	107,99

(b)

After one year and interest payment the price of bond is equal to the sum of discounted
four interest payments and repayment of the par value at maturity.

$$P_1 = \frac{10\% \times 100}{(1+8\%)^1} + \frac{10\% \times 100}{(1+8\%)^2} + \frac{10\% \times 100}{(1+8\%)^3} + \frac{10\% \times 100 + 100}{(1+8\%)^4} = 106,62$$

Price after interest payment   106,62
Interests   10,00
Price before interest payment   116,62

Assuming that YTM is the the same the discounted price of t=1 is equal to the price at t=0.

$$P_0 = \frac{116,2}{(1+8\%)} = 107,99$$

The price of a bond should be in the range of (107,99; 116,62).

(c)

After 90 days, there is 275 days to the first interest payment. This is a 0,753 fraction of a year.
Maturity is equal 4,753 years. The price of a bond is:

$$P = \frac{10}{(1+0,12)^{0,753}} + \frac{10}{(1+0,12)^{1,753}} + \frac{10}{(1+0,12)^{2,753}} + \frac{10}{(1+0,12)^{3,753}} + \frac{110}{(1+0,12)^{4,753}} = 95,42$$

Clean price   92,96 using Excel
Accrued interests   2,47 =10%*100*90/365
Dirty price   95,42

Period	0,753	1,753	2,753	3,753	4,753
Cash flow	10	10	10	10	110
Discounting factor	0,9182	0,8198	0,7320	0,6535	0,5835
Discounted cash flow	9,18	8,20	7,32	6,54	64,19
Cummulated cash flow	9,18	17,38	24,70	31,23	95,42

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Problem 65

A company is considering the acquisition of 10 personal computers. The computers can be purchased for $3500 each and would be depreciated straight line over 5 years. Their estimated final value at the end of 5 years is $0. The purchase may be financed with a loan. Before-tax cost of debt is 14%. The tax rate is 40%. Alternatively, the 10 computers can be leased for $10000 annually, payable at the end of each year.
(a) Calculate the sum of discounted cashflows (PV) when the company purchases computers.
(b) Calculate the sum of discounted cashflows (PV) when the company leases computers.
(c) Show the sensitivity of PV to interest rate.

Solution

(a)

Purchase. Cash flows = loan payment - tax saving:

Year	Loan Payment	Interest	Principal	Loan Balance	Depreciation	Expense	Tax Saving	Cash Flows
0				35000,0				
1	10194,9	4900,0	5294,9	29705,1	7000,0	11900,0	4760,0	5434,9
2	10194,9	4158,7	6036,2	23668,9	7000,0	11158,7	4463,5	5731,4
3	10194,9	3313,6	6881,3	16787,6	7000,0	10313,6	4125,5	6069,5
4	10194,9	2350,3	7844,7	8942,9	7000,0	9350,3	3740,1	6454,8
5	10194,9	1252,0	8942,9	0,0	7000,0	8252,0	3300,8	6894,1
	$\aleph =$		35000,0				PV =	23 937,3

(b)

Leasing. Cash flows = after tax lease payment

| Year	Lease Payment	After Tax Lease Payment
1	10000,0	6000,0
2	10000,0	6000,0
3	10000,0	6000,0
4	10000,0	6000,0
5	10000,0	6000,0
	PV =	23 705,8

PV of expenses

Purchase	23 937,3
Leasing	23 705,8
	231,5

It is better to lease.

(c)

	Leasing	Purchase
	23706	23937
4%	27955	21954
6%	27014	22394
8%	26121	22810
10%	25274	23205
12%	24470	23581
14%	23706	23937
16%	22979	24276
18%	22287	24599
20%	21629	24907

Sensitivity Analysis of NPV to Interest Rate
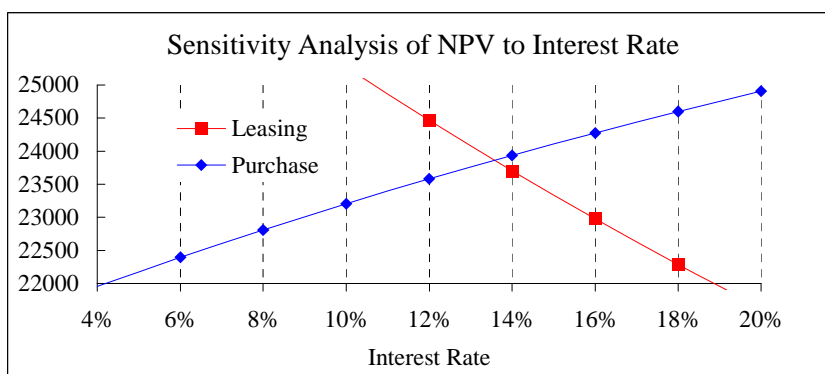
Problem 66

A leasing company has just received on order from a client who wishes to lease 10 computers for 5 years. The leasing company can buy computers for $3500 each. It will depreciate them straight line to a salvage value $0 in five years. It will finance this project with debt.
Before-tax cost of debt is 13,33%. Lease payments will be received at the end of each year and are subject to taxation immediately upon receipt. The leasing company is in the 40% tax bracket.
(a) Calculate lease payment required to to breakeven the leasing comany expenses.
(b) Calculate lease payment if required NPV for a leasing company is equal to $135,8.

Solution

(a)

Discount rate (after-tax cost of debt):   8%

Investment cost is $35 000. Annual tax saving is 35000 / 5 x 40% = 2800.

First, we calculate the present value of tax savings:

	1	2	3	4	5	
Tax savings	2 800	2 800	2 800	2 800	2 800	
Discounting factor	0,93	0,86	0,79	0,74	0,68	PV
Discounted tax savings	2593	2401	2223	2058	1906	11180

Next, we find the annual after-tax lease payment that gives the PV equal to $23820.
Lease payment can be calculated with the PMT function: PMT(8%;5;-23820,4;;0) = $5966.
The before-tax lease payment should be $9943,3.
The present value of tax savings and lease payments will be equal to zero.

	0	1	2	3	4	5	
Investment	-35000						
Tax savings		2 800	2 800	2 800	2 800	2 800	
Lease payments		5 966	5 966	5 966	5 966	5 966	
Cash Flows	-35 000	8 766	8 766	8 766	8 766	8 766	
Discounting factor	1,0000	0,9259	0,8573	0,7938	0,7350	0,6806	PV
DCF	-35000,0	8116,6	7515,4	6958,7	6443,3	5966,0	0,0

(b)

Now we have to find lease payment which gives the present value equal to
23820,4 + 135,8 = $23956,3.
Lease payment can be calculated with the PMT function: PMT(8%;5;-23956,3;;0) = $6000.
The before-tax lease payment should be $10000,0.
The present value of tax savings and lease payments will be equal to $135,8.

	0	1	2	3	4	5	
Investment	-35000						
Tax savings		2 800	2 800	2 800	2 800	2 800	
Lease payments		6 000	6 000	6 000	6 000	6 000	
Cash Flows	-35 000	8 800	8 800	8 800	8 800	8 800	
Discounting factor	1,0000	0,9259	0,8573	0,7938	0,7350	0,6806	PV
DCF	-35000,0	8148,1	7544,6	6985,7	6468,3	5989,1	135,8

Note on the Tax savings row for part (b): the year 0 column shows 0.