UNIVERSITY OF CALGARY
HASKAYNE SCHOOL OF BUSINESS

Corporate Finance

Capital Budgeting for the Levered Firm

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Agenda

Capital budgeting for the levered firm

- Weighted Average Cost of Capital (WACC)
  - Beta with regard to corporate taxes
- Adjusted Present Value (APV)
- Flow to Equity (FTE)
- Comparison

Optimal capital structure with a credit step function

Chapter 18 of the textbook

Ignoring capital structure issues, capital budgeting could limit itself to four steps:

a) Determine the cash flows
b) Assess the risk of the project
c) Estimate a commensurate opportunity cost of capital
d) Calculate NPV

Once capital structure issues are taken into consideration, three slightly different capital budgeting approaches can be used:

- Weighted Average Cost of Capital (WACC)
- Adjusted Present Value (APV)
- Flow to Equity (FTE)

WACC

$$r_{WACC} = \frac{Debt}{Debt + Equity} r_{Debt} (1 - T_c) + \frac{Equity}{Debt + Equity} r_{Equity}$$

Simply calculate the NPV using a cost of capital that recognizes usage of debt and its related tax benefit (i.e. $1 - T_c$). Debt and equity at market value or per firm target capital structure. There is an built-in assumption that the WACC is likely to be constant throughout the life of the project.

Practitioners use the WACC approach most of the time.

Beta with regard to corporate taxes

No corporate taxes

$$\beta_{Asset} = \frac{Debt}{Debt + Equity}\beta_{Debt} + \frac{Equity}{Debt + Equity}\beta_{Equity}$$

$$\beta_{Equity} = \beta_{Asset}\left(1 + \frac{Debt}{Equity}\right) \quad assuming \;\; \beta_{Debt} = 0$$

With corporate taxes

$$\beta_{Equity} = \beta_{Asset}\left(1 + \frac{Debt\,(1 - T_C)}{Equity}\right) \quad assuming \;\; \beta_{Debt} = 0$$

Adjusted Present Value

$$APV = NPV + NPVF$$

Once the net present value (NPV) of a project is calculated as if the firm was unlevered, it is adjusted by the present value of the induced effects of financing ($NPVF$).

The induced effects of financing are:

- The tax shield afforded to debt;
  - i.e. interest payments on debt are usually recognized as an expense for corporate tax calcualtions, therefore reducing the corporate income tax paid and acting like a tax subsidy for debt financing.
- The costs of financial distress;
- The costs of issuing new securities.

The key advantage of the APV is that the value-creation contributions of the project itself and of the tax-benefits of debt are made distinct. In addition, the APV approach can accommodate situations for which leverage is expected to decrease (or increase) throughout the life of the project.

Flow to Equity

Calculate the net present value of the project from the perspective of the shareholders.

a) Determine the levered cash flows (i.e. the cash flows available to be paid out to shareholders, basically the after-tax cash flows usually used to calculate the NPV using WACC, less any cash flows like interest payment to debtholders on an after-tax basis)
b) Estimate r_{EL} (the expected return to equity, given the leverage)
c) Calculate NPV as usual, but using the levered cash flows and r_{EL}

$$\textit{Levered Cash Flow} = \textit{Unevered Cash Flow} - (1 - T_c) \times r_D \times D$$

Comparison

	APV	WACC	FTE
Initial investment	all	all	equity portion
Cash flows	UCF	UCF	LCF
Discount rate	r_{EU}	r_{WACC}	r_{EL}
PV of financing	yes	no	no

The Adjusted Present Value could be of interest if the project's level of debt is known over the life of the project (e.g. project finance)

Otherwise (i.e. the firm's target debt-to-equity ratio prevails), the two other approaches are more useful.

Optimal capital structure with a credit step function

You are being asked to find the optimal capital structure for a firm while being provided with the below-noted data (single factor credit rating schedule).

Firm		**Credit rating schedule**			
Equity	125	Int. coverage ratio		Rating	Spread
EBIT	10	0	0.2	D	19.38%
Beta	1	0.2	0.65	C	15.54%
Tax rate	25%	0.65	0.8	CC	11.08%
5-year Rf	3%	0.8	1.25	CCC	9.00%
MRP	5%	1.25	1.5	B-	6.60%
Ru	8%	1.5	1.75	B	5.40%
		1.75	2	B+	4.50%
		2	2.25	BB	3.60%
		2.25	2.5	BB+	3.00%
		2.5	3	BBB	2.00%
		3	4.25	A-	1.56%
		4.25	5.5	A	1.38%
		5.5	6.5	A+	1.25%
		6.5	8.5	AA	1.00%
		8.5		AAA	0.75%

Optimal capital structure with a credit step function

See Excel file in D2L (NB need to iterate as the credit rating influences the interest rate which influences the coverage ratio which determines the credit rating).

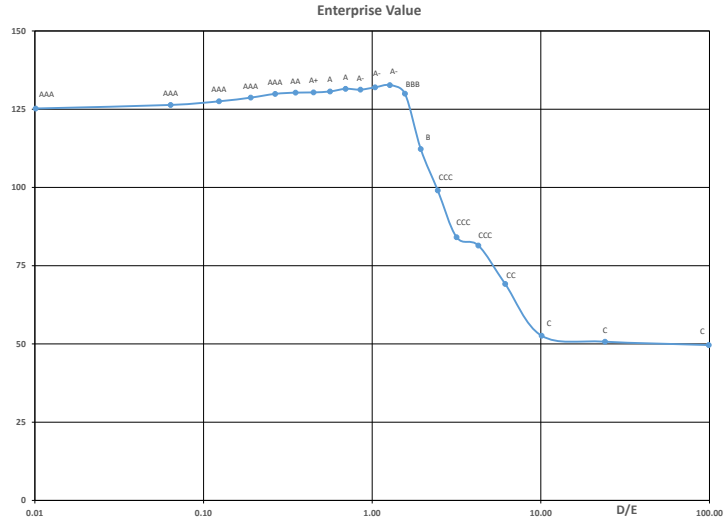
D	E	D/E	Beta	Rel	D	Rate	Rating	Rate	Tax	AT Debt	Equity	WACC	EV
1%	99%	0.01	1.01	8.0%	1.25	3.75%	AAA	3.75%	25%	2.81%	8.04%	7.99%	125.2
6%	94%	0.06	1.05	8.2%	7.50	3.75%	AAA	3.75%	25%	2.81%	8.24%	7.91%	126.4
11%	89%	0.12	1.09	8.5%	13.75	3.75%	AAA	3.75%	25%	2.81%	8.46%	7.84%	127.5
16%	84%	0.19	1.14	8.7%	20.00	3.75%	AAA	3.75%	25%	2.81%	8.71%	7.77%	128.7
21%	79%	0.27	1.20	9.0%	26.25	3.75%	AAA	3.75%	25%	2.81%	9.00%	7.70%	129.9
26%	74%	0.35	1.26	9.3%	32.50	3.75%	AA	4.00%	25%	3.00%	9.32%	7.68%	130.3
31%	69%	0.45	1.34	9.7%	38.75	3.75%	A+	4.25%	25%	3.19%	9.68%	7.67%	130.4
36%	64%	0.56	1.42	10.1%	45.00	3.75%	A	4.38%	25%	3.29%	10.11%	7.65%	130.7
41%	59%	0.69	1.52	10.6%	51.25	3.75%	A	4.38%	25%	3.29%	10.61%	7.60%	131.5
46%	54%	0.85	1.64	11.2%	57.50	3.75%	A-	4.56%	25%	3.42%	11.19%	7.62%	131.3
51%	49%	1.04	1.78	11.9%	63.75	3.75%	A-	4.56%	25%	3.42%	11.90%	7.58%	132.0
56%	44%	1.27	1.95	12.8%	70.00	3.75%	A-	4.56%	25%	3.42%	12.77%	7.54%	132.7
61%	39%	1.56	2.17	13.9%	76.25	3.75%	BBB	5.00%	25%	3.75%	13.87%	7.70%	130.0
66%	34%	1.94	2.46	15.3%	82.50	3.75%	B-	9.60%	25%	5.63%	15.28%	8.91%	112.3
71%	29%	2.45	2.84	17.2%	88.75	3.75%	CCC	12.00%	25%	7.20%	17.18%	10.09%	99.1
76%	24%	3.17	3.38	19.9%	95.00	3.75%	CCC	12.00%	22%	9.37%	19.88%	11.89%	84.1
81%	19%	4.26	4.20	24.0%	101.25	3.75%	CCC	12.00%	21%	9.53%	23.99%	12.28%	81.4
86%	14%	6.14	5.61	31.0%	107.50	3.75%	CC	14.08%	17%	11.75%	31.04%	14.45%	69.2
91%	9%	10.11	8.58	45.9%	113.75	3.75%	C	18.54%	12%	16.34%	45.92%	19.00%	52.6
96%	4%	24.00	19.00	98.0%	120.00	3.75%	C	18.54%	11%	16.46%	98.00%	19.72%	50.7
99%	1%	99.00	75.25	379.3%	123.75	3.75%	C	18.54%	11%	16.52%	379.25%	20.15%	49.6

Optimal capital structure with a credit step function

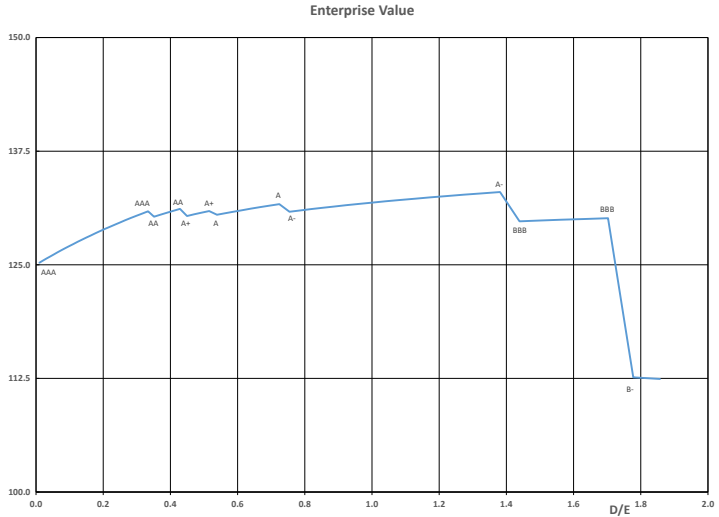
Observations

- While this simulation is realistic, the credit step function is driven by a single factor. In reality, several factors will influence the credit rating of an issuer and most likely be industry-specific while the spreads vary through time (i.e. the so-called credit cycle).
- The spreads for investment grade issuers (i.e. between AAA and BBB) are small, but become quickly significant for non-investment grade issuers (i.e. below BBB, aka 'speculative grade' or 'junk bonds'). Not only this reflects increased risk of default, but also potential lack of liquidity as many institutional investors are prohibited (or reluctant) to invest in non-investment grade bonds.
- As shown in the following graphs, a strong financial incentive exists for a firm to be 'investment grade' (if possible), and then to use as much of the headroom provided within a specific credit rating without taking too much risk of being downgraded.

Optimal capital structure with a credit step function



Optimal capital structure with a credit step function



Chapter 18 of the textbook

Textbook sections covered

- 18.1 to 18.8

Worked examples

- Four worked examples are provided in chapter 18 of the textbook.

Exercises

- 17 exercises are provided in chapter 18 of the textbook.
- You should practice your Excel skills with a few of those.
- Suggest 18.5, 18.14 and 18.17
- Hints
  - 18.5: a) 1.87 and 2.31; b) 18.58% and 21.73%
  - 18.14: a) 85,312,500 65.63; b) 95,812,500 73.70; c) 407,045 65,812,500 73.70
  - 18.17: yes NPV=373,712

18.5 Solution

	North	South
Beta U	1.25	1.25
Debt	2,900,000	3,800,000
Equity	3,800,000	2,900,000
Rm	12.40%	12.40%
Rf	5.30%	5.30%
Tc	35%	35%
Equity Beta	1.87	2.31
Rel	18.58%	21.73%

18.14 Solution

EBIT	21,000,000	Vu	85,312,500	EBIT(1-Tc)/Ru
Ru	16%	Stock price	65.63	Vu/Nb._Shares
Nb._Share	1,300,000			
Tc	35%	NPV	10,500,000	Debt X Tc
Debt	30,000,000	Vl	95,812,500	Vl=Vu+NPV
R_debt	9%	Stock price	73.70	Vl/Nb._Shares
		Shares_ pur	407,045	Debt/Stock price
		Shares_out.	892,955	Nb_shares-purch.
		Vel	65,812,500	Vl-Debt
		Stock price	73.70	Vel/Shares_out.

Rl	18.07%	Ru+(D/E)(Ru-R_debt)(1-Tc)
EBIT	21,000,000	
Interest	2,700,000	
Taxes	6,405,000	
Nl	11,895,000	
Vel	65,812,500	Nl/Rl

18.17 Solution

Target D/E		0.4	Ind Bl	13.40%	Cash flows		
Industry D/E		0.35	Reu ind	11.94%	0	-	675,000
Industry B		1.2	Rel	13.61%	1		95,000
MRP		7%	WACC	10.58%	2		99,750
Rf		5%	NPV	373,712	3		104,738
Tc		40%			4		109,974
C0	-	675,000			5		1,207,177
C1		95,000					
g up to year 5		5%					