AcF302: Corporate Finance

Capital Budgeting and Valuation with Leverage - Part II

Week 12

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TRIPLE-ACCREDITED, WORLD-RANKED

Relaxing the assumption that the project has average risk:

- In the real world, a specific project may have different market risk than the average project for the firm.

- In this case, the firms’ average cost of capital cannot be used to value the project.

- How can we calculate the project’s cost of capital in this case?

- Suppose Avco launches a new plastics manufacturing division that faces different market risks to its main packaging business.
  - The unlevered cost of capital for the plastics division can be estimated by looking at other single-division plastics firms that have similar business risks.

- Assume two firms are comparable to the plastics division and have the following characteristics:

Firm	Equity Cost of Capital	Debt Cost of Capital	Debt-to-Value Ratio
Comparable #1	12.0%	6.0%	40%
Comparable #2	10.7%	5.5%	25%

- Assuming that both firms maintain a target leverage ratio, the unlevered cost of capital for each competitor can be estimated by calculating their pretax WACC.

$$\text{Competitor 1}: r_U = 0.60 \times 12.0\% + 0.40 \times 6.0\% = 9.6\%$$
$$\text{Competitor 2}: r_U = 0.75 \times 10.7\% + 0.25 \times 5.5\% = 9.4\%$$

- Based on the average R_u of these comparable firms, we can estimate an unlevered cost of capital for the plastics division of 9.5%.

- To use the WACC method we need to estimate the project's equity cost of capital. Why can't we use the original cost of equity of 10%?

- The project's equity cost of capital can be calculated as follows:

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

- Assume that Avco plans to maintain its debt-to-value ratio of 50% as it expands into plastics manufacturing, and it expects its borrowing cost to remain at 6%.
  - Given the unlevered cost of capital estimate of 9.5%, the plastics division's equity cost of capital is estimated to be

$$r_E = 9.5\% + \frac{0.50}{0.50}(9.5\% - 6\%) = 13.0\%$$

- The division's WACC can now be estimated to be

$$r_{WACC} = 0.50 \times 13.0\% + 0.50 \times 6.0\% \times (1 - 0.40) = 8.3\%$$

Alternatively, $r_{wacc} = r_u - d\, T_c\, r_d$ = 9.5% – (50% * 40% * 6%) = 8.3%

Relaxing the assumption of constant Debt-to-Equity ratio:

- Up to this point, it has been assumed that the firm wishes to maintain a constant debt-equity ratio.

- Two alternative leverage policies will now be examined.
    - Constant interest coverage.
    - Predetermined debt levels.

Constant Interest Coverage Ratio

- When a firm keeps its interest payments equal to a target fraction of its free cash flows (FCF / Interest Expense = constant)

- If the target fraction is *k*, then

$$\text{Interest Paid in Year } t = k \times FCF_t$$

- To implement the APV approach, the PV of the tax shield under this policy needs to be computed:

$$PV(\text{Interest Tax Shield}) = PV(\tau_c k \times FCF) = \tau_c k \times PV(FCF)$$
$$= \tau_c k \times V^U$$

  – With a constant interest coverage policy, <u>the present value of the interest tax shield is proportional to the project's unlevered value</u>.

Constant Interest Coverage Ratio

- The value of the levered project, using the APV method, is:

$$V^L = V^U + PV(\text{interest tax shield}) = V^U + \tau_c k \times V^U$$
$$= (1 + \tau_c k)V^U$$

Back to the acquisition example

Valuing an Acquisition with Target Interest Coverage Problem

Consider again Avco's acquisition.

Remember that the acquisition will contribute $3.8 million in free cash flows the first year, growing by 3% per year thereafter.

The acquisition cost of $80 million will be financed with $50 million in new debt initially.

Compute the value of the acquisition using the APV method assuming Avco will maintain a constant interest coverage ratio for the acquisition.

Solution

Given Avco's unlevered cost of capital of r_U = 8%, the acquisition has an unlevered value of

$$V^U = \frac{3.8}{(8\% - 3\%)} = \$76\text{million}$$

With \$50 million in new debt and a 6% interest rate, the interest expense the first year is 6% x 50 = \$3 million, or $k = \frac{\text{Interest}}{\text{FCF}} = \frac{3}{3.8} = 78.95\%$.

Because Avco will maintain this interest coverage, we can compute the levered value as:

$$V^L = (1 + T_C k)V^U = [1 + 0.4(78.95\%)]76 = \$100 \text{ million}$$

Predetermined Debt Levels

- Rather than set debt according to a target debt-equity ratio or interest coverage level, a firm may adjust its debt according to a fixed schedule that is known in advance.

- Assume now that Avco plans to borrow $30.62 million and then will reduce the debt on a fixed schedule
  - to $20 million after one year, to $10 million after two years, and to $0 after three years

- The RFX project will have no other consequences for Avco's leverage. Because Avco does not want to maintain a constant D/E ratio, the company's debt in future periods is independent of the project's cash flows.

Remember: With a constant Debt-to-Equity ratio

	Year	0	1	2	3	4
Interest Tax Shield ($ million)						
1 **Debt Capacity, D_t (at $d = 50\%$)**		30.62	23.71	16.32	8.43	—
2 Interest Paid (at $r_D = 6\%$)			1.84	1.42	0.98	0.51
3 **Interest Tax Shield (at $\tau_c = 40\%$)**			**0.73**	**0.57**	**0.39**	**0.20**

With a fixed debt schedule

	Year	0	1	2	3	4
Interest Tax Shield ($ million)						
1 **Debt Capacity, D_t (fixed schedule)**		30.62	20.00	10.00	—	—
2 Interest Paid (at $r_D = 6\%$)			1.84	1.20	0.60	—
3 **Interest Tax Shield (at $\tau_c = 40\%$)**			**0.73**	**0.48**	**0.24**	—

Predetermined Debt Levels

- Note: <u>When debt levels are set according to a fixed schedule, we can discount the predetermined interest tax shields using the debt cost of capital.</u>

$$PV(\text{interest tax shield}) = \frac{0.73}{1.06} + \frac{0.48}{1.06^2} + \frac{0.24}{1.06^3} = \$1.32 \text{ million}$$

- The levered value of Avco's project is:

$$V^L = V^U + PV(\text{Interest tax shield}) = 59.62 + 1.32 = \$60.94 \text{ million}$$

- Special case of predetermined debt level: When a firm has permanent fixed debt, maintaining the same level of debt forever, the levered value of the project simplifies to

Levered Value with Permanent Debt $\quad V^L = V^U + \tau_c \times D$

A Comparison of Methods

- Typically, the WACC method is the easiest to use when the firm will maintain a constant debt-to-equity ratio over the life of the investment.

- With other leverage policies (e.g., constant interest coverage and fixed debt schedules), when we relax the assumption of a constant debt-equity ratio, the equity cost of capital and WACC for a project will change over time as the debt-equity ratio changes.

- As a result, the WACC and FTE methods are difficult to implement and the APV method is usually the simplest approach.

Relaxing the assumption that corporate taxes are the only imperfection:

- **Issuance and Other Financing Costs**
  - When a firm raises capital by issuing securities, the banks that provide the loan or underwrite the sale of the securities charge fees.
  - These fees should be included as part of the project's required investment, reducing the NPV of the project.

For example, suppose a project has a levered value of \$20 million and requires an initial investment of \$15 million. To finance the project, the firm will borrow \$10 million and fund the remaining \$5 million by reducing dividends. If the bank providing the loan charges fees (after any tax deductions) totaling \$200,000, the project NPV is

$$
\begin{aligned}
NPV &= V_L - (\text{Investment}) - (\text{After Tax Issuance Costs}) \\
&= 20 - 15 - 0.2 \\
&= \$4.8 \text{ million}
\end{aligned}
$$

Typical Issuance Costs for Different Securities, as a Percentage of Proceeds

Financing Type	Underwriting Fees
Bank loans	< 2%
Corporate bonds	
Investment grade	1 − 2%
Non − investment grade	2 − 3%
Equity issues	
Initial public offering	8 − 9%
Seasoned equity offering	5 − 6%

Security Mispricing

- If the financing of the project involves an equity issue, and if management believes that the equity will sell at a price that is less than its true value, this mispricing is a cost of the project for **existing shareholders**.

- It should be deducted from the project NPV in addition to other issuance costs.

Financial Distress and Agency Costs

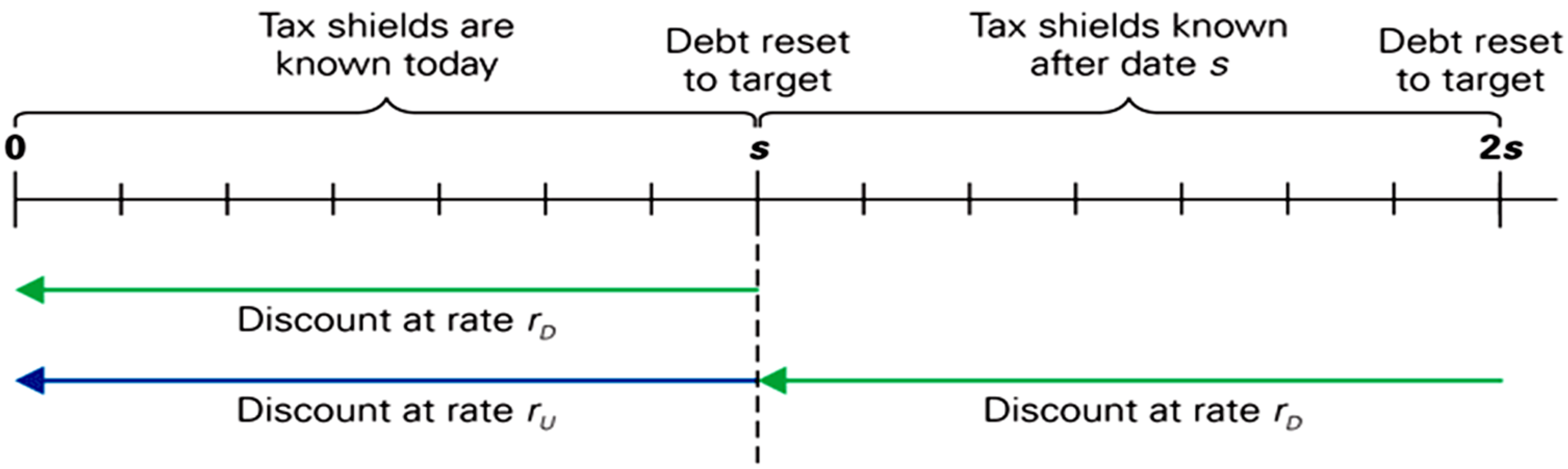
- The free cash flow estimates for a project should be adjusted to include expected financial distress and agency costs.

- Financial distress and agency costs also impact the cost of capital.
  – For example, financial distress costs tend to increase the sensitivity of the firm's value to market risk, raising the unlevered cost of capital for highly levered firms.

Advanced Topics

- **Periodically Adjusted Debt**
  - To this point, we have considered leverage policies in which debt is either adjusted continuously to a target leverage ratio or set according to a fixed plan that will never change.
  - In the "real world," most firms allow their debt-to-equity ratio to deviate from its target and periodically adjust leverage to bring it back into line with the target.

- Suppose the firm adjusts its leverage every *s* periods. The firm's interest tax shields up to date *s* are predetermined and should be discounted at rate r_D.



- Interest tax shields that occur after date *s* depend on future adjustments the firm will make to its debt, so they are risky.
- Therefore, the future interest tax shields should be discounted at rate r_D for the periods that they are known, but at rate r_U for all earlier periods when they are still risky.

- **Periodically Adjusted Debt**
  - An important special case is when the debt is adjusted annually.

$$PV(\tau_c \times Int_t) = \frac{\tau_c \times Int_t}{(1+r_U)^{t-1}(1+r_D)} = \frac{\tau_c \times Int_t}{(1+r_U)^t} \times \left(\frac{1+r_U}{1+r_D}\right)$$

$$r_{WACC} = r_U - d\tau_c r_D \frac{1+r_U}{1+r_D} \qquad V^L = \left(1+\tau_c k \frac{1+r_U}{1+r_D}\right) V^U$$

- We can then value the tax shield by discounting it at rate r_U as before, and then multiply the result by the factor $(1 + r_U)/(1 + r_D)$ to account for the fact that the tax shield is known one year in advance.

Example

Annual Debt Ratio Targeting

Celmax Corporation expects FCFs this year of $7.36 million and a future growth rate of 4% per year.

The firm currently has $30 million in debt outstanding. This leverage will remain fixed during the year, but at the end of each year Celmax will increase or decrease its debt to maintain a constant debt-to-equity ratio.

Celmax pays 5% interest on its debt, pays a corporate tax rate of 40%, and has an unlevered cost of capital of 12%.

Estimate Celmax's value with this leverage policy.

Solution

Using the APV approach, the unlevered value is $V^U = \dfrac{7.36}{(12\% - 4\%)} = \$92.0$ million.

In the first year, Celmax will have an interest tax shield of

$$\tau_c r_D D = 0.40 \times 5\% \times \$30 \text{ million} = \$0.6 \text{ million.}$$

Because Celmax will adjust its debt after one year, the tax shields are expected to grow by 4% per year with the firm. The present value of the interest tax shield is therefore

$$PV\ (Interest\ Tax\ Shield) = \underbrace{\frac{0.6}{(12\% - 4\%)}}_{PV \text{ at rate } r_U} \times \underbrace{\left(\frac{1.12}{1.05}\right)}_{\text{Debt is set 1 year in advance}} = \$8.0 \text{ million}$$

Therefore, $V^L = V^U + PV$ (Interest Tax Shield) = 92.0 + 8.0 = \$100.0 million.

Personal Taxes

- For individuals, interest income from debt is generally taxed more heavily than income from equity (capital gains and dividends).
  - So how do personal taxes affect our valuation methods?
- The equity and debt costs of capital in the market already reflect the effects of investor taxes.
- Therefore, the WACC method does not change in the presence of investor taxes.

Personal Taxes

- However, the APV approach requires modification in the presence of investor taxes because it requires the computation of the unlevered cost of capital.
  - r_D should be adjusted as follows:

$$r_D^* \equiv r_D \frac{(1-\tau_i)}{(1-\tau_e)}$$

What debtholders should ask for if they were paying the same lower personal taxes as equity holders.

$$r_D^*(1-\tau_e) = r_D(1-\tau_i)$$

Personal Taxes

- The unlevered cost of capital becomes

$$r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D^*$$

- The effective tax rate is

$$\tau^* = 1 - \frac{(1-\tau_c)(1-\tau_e)}{(1-\tau_i)}$$

- The interest tax shield is then calculated as

$$\text{Interest Tax Shield in Year } t = \tau^* \times r_D^* \times D_{t-1}$$

Example

Using the APV Method with Personal Taxes

Problem

Apex Corporation has an equity cost of capital of 14.4% and a debt cost of capital of 6%, and the firm maintains a debt-equity ratio of 1. Apex is considering an expansion that will contribute $4 million in FCFs the first year, growing by 4% per year thereafter. The expansion will cost $60 million and will be financed with $40 million in new debt initially with a constant debt-equity ratio maintained thereafter. Apex's corporate tax rate is 40%; the tax rate on interest income is 40%; and the tax rate on equity income is 20%. Compute the value of the expansion using the APV method.

Solution

First, we compute the value without leverage (Vu). The debt cost of capital of 6% is equivalent to an equity rate of

$$r_D^* = r_D \frac{1-\tau_i}{1-\tau_e} = 6\% \times \frac{1-0.40}{1-0.20} = 4.5\%$$

$$r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D^* = 0.50 \times 14.4\% + 0.50 \times 4.5\% = 9.45\%$$

Therefore, $V^U = \dfrac{4}{(9.45\% - 4\%)} = \$73.39$ million.

$$\tau^* = 1 - \frac{(1-\tau_e)(1-\tau_e)}{(1-\tau_i)} = 1 - \frac{(1-0.40)(1-0.20)}{1-0.40} = 20\%$$

Apex will add new debt of \$40 million initially, so the interest tax shield is 20% × 4.5% × 40 = \$0.36 million the first year (note that we use r_D^* here).

With a growth rate of 4%, the PV of the interest tax shield is

$$PV(\text{Interest Tax Shield}) = 0.36 \div (9.45\% - 4\%) = \$6.61 \text{million}$$

Therefore, the value of the expansion with leverage is given by the APV:

$$V^L = V^U + PV(\text{Interest tax shield}) = 73.39 + 6.61 = \$80 \text{million}$$

Given the cost of \$60 million, the expansion has an NPV of \$20 million.