VALUATION AND CAPITAL BUDGETING WITH LEVERAGE: WACC, APV, AND FTE

A few new valuation methods

- To value a project or firm, we have used the “WACC DCF method:
  1. Calculate FCFs (assuming all-equity financed)
  2. Discount FCFs using r_{wacc}
- Now we will look at two other “DCF” methods, **APV** and **FTE**
  - Both do discounting of cash flows (*i.e.*, they are “DCF”)
  - Achieve the same goal (=value a firm or project)
  - But have some advantages (and disadvantages) relative to the WACC method
- A common application for these are when capital structure is complicated or changing over time or (e.g., in private equity deals)

Recall: The Interest Tax Shield (ITS)

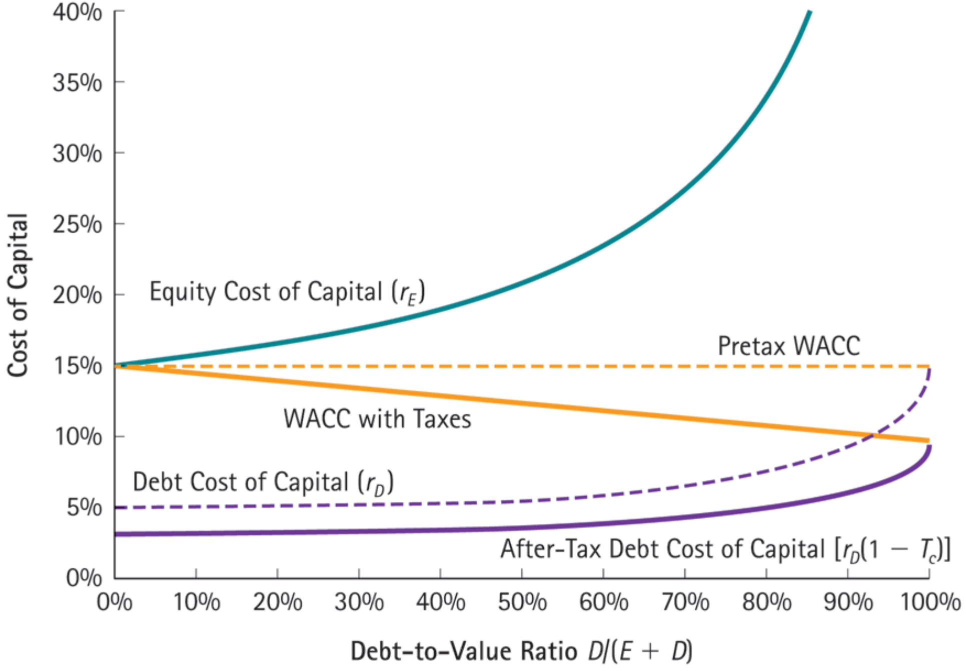
- If we issue debt to finance our project/firm, we get to deduct interest
- The resulting interest tax shield (ITS) is valuable!
  - Makes a debt-financed project/firm more valuable than a project/firm with less debt

WACC vs. APV method

- Both methods involve discounting free cash flows, <u>but</u>
- WACC method adjusts the <u>discount rate</u> to reflect ITS:
  - Use r_{wacc} to discount FCFs, which is lower than r_u
  - The difference between r_{wacc} and r_u captures the value of the tax benefit
- APV method explicitly adds <u>cash flows</u> to reflect the ITS:
  - Use r_u to discount project's/firm's FCFs (as if all-equity financed)
  - Then add extra cash flows resulting from the ITS
  - Use either r_u or r_d to discount the added ITS cash flows (depending on how risky these tax savings are)

Recall: r_{wacc} $vs.$ r_u

$$r_{wacc} = r_u - \frac{D}{V} r_d t_c$$



Example: Frozen Treat

- The Frozen Treat Co. makes premium hand-made ice cream
  - Cost of debt (r_D) = .5%
  - Cost of equity (r_E) = 12%
  - Marginal tax rate (t_C) = 30%
  - Debt ratio (D/V) = 40%
  - Equity ratio (E/V) = 60%
- r_{wacc} = 12% x .6 + 5% x .4 x (1-0.3) = 8.6%

Example: Frozen Treat (cont.)

- Frozen Treat considers investing \$12.5m in a perpetual ice machine
- Ice machine will generate perpetual EBIT of \$1.535m per year
  - For simplicity, let's assume no further capex, no depreciation, NWC, so then the perpetual future cash flows would be:

    FCF=EBIT(1-t_c) = \$1.075m
- Project has same risk as Frozen Treat's other operations and it would be financed with the same leverage, D/V=40%
  - With same risk and capital structure, r_{wacc} stays the same as the corporate!
  - Otherwise, we must adjust r_{wacc} for differences in systematic risk (r_a) or leverage
- NPV = -\$12.5m + \$1.075m / 8.6% = 0
- Project exactly breaks even!

Adjusted Present Value (APV)

- Three Steps for Calculating APV:
  1. Do valuation assuming 100% equity financing
  2. Determine additional cash flows from the ITS (including terminal value of ITS) and discount these cash flows
  3. Determine and discount the cash flows from other financing effects (if any), such as costs of financial distress or issuance costs

$$APV = V_{\text{all equity}} + PV(\text{financing choices, including ITS})$$

1. Valuing the ITS: Cash Flows

- ITS results in a positive cash flow effect in every period t:

$$ITS_t = t_c * interest_t$$

<u>Some Comments:</u>

- We usually only consider corporate taxes
  - We could also consider the investors' individual tax rates, but we rarely do so in practice
- ITS is only valuable if EBIT is positive (and only to the extent EBIT is higher than the interest payments)
  - Alternatively, we must keep track of loss carryforwards, etc.

2. Valuing the ITS: Discount Rate

- Two candidates for discount rate for ITS:
  1. We might use r_d, because this reflects the risk of the debt that is creating the tax shields
  2. We might use r_a, because this reflects the risk of the assets that generate profits, and we need profits to benefit from the tax shields
- **In general, I recommend using r_a when the "leverage ratio" target is fixed, and r_d when the "dollar debt" target is fixed**
  — To see why r_a is a good choice with fixed D/V, consider that the debt levels (and thus the interest payments and ITS) will correlate perfectly with the value of the firm's assets, and thus have the same systematic risk
  — If debt amount is fixed, the ITS is less risky than the firm's assets, but still has the same risk as the debt itself, so we discount it at r_d

Example: APV of Frozen Treat’s Ice Machine

- Recall, we are considering investing \$12.5m in a perpetual ice machine, generating after tax cash flow of \$1.075m
- We know: r_d = 5%, r_e = 12%, D/V = 40%, and t_c = 30%
- WACC method found NPV = 0
- What does the APV method find?

Example: APV of Frozen Treat's Ice Machine (contd.)

- First, calculate NPV as if investment is all equity financed
  - r_a = 12% x 60% + 5% x 40% = 9.2%
  - $NPV_{ALL\ E}$ = -\$12.5m + \$1.075m/9.2% = -\$0.82m
- Value of ITS
  - Each period, interest payment is 5% of \$5m = \$.25m
  - Tax savings each period is \$.25m x 30% = \$.075m
  - PV(ITS) = \$.075m / 9.2% = \$0.82m
    - we discount the ITS using r_a here…
- APV = $NPV_{ALL\ EQUITY}$ + PV(ITS) = -\$0.82m + \$0.82m = 0 !

Should we use WACC or APV method?

- Both methods account for the value of the ITS
- WACC adjusts the discount rate
  - Simpler and more widely used
  - Less flexible and requires stronger assumptions—e.g. implicitly assumes that firm/project targets a constant D/V ratio
  - Cannot account for other (non-tax) financial effects that may favor debt or equity financing (e.g., costs of financial distress, issuance costs, agency costs, etc.)
- APV adds cash flows from ITS separately
  - A bit more complicated because of extra step - Requires explicitly deriving schedule of future debt levels and interest payments
  - Does not need to assume constant D/V ratio
  - Allows accounting for other effects of financing choices – for example, financial distress costs, agency costs, issuance costs, etc.
  - Separates the value of the assets from the value created by the financing decision
- APV is, for example, the best choice in situations that involve complex capital structures or changing debt levels

The tax shield and (un)levering betas

- Corporate taxes can affect the (un)levering formulas we've used previously
  - This happens if the ITS does not have the same risk as the firm's business operations (V)
  - The formulas will depend on whether the firm targets a fixed leverage ratio (in which case D and the ITS will have the same risk as V) or fixed amount of debt

- Method 1:

$$\beta_a = \beta_e \frac{E}{E+D} + \beta_d \frac{D}{E+D}$$

  - This is correct when the company you are levering/unlevering maintains a fixed leverage ratio
  - Holds even with corporate taxes
  - We usually use this method

- Method 2:

$$\beta_a = \beta_e \frac{E}{E+(1-t_c)D} + \beta_d \frac{(1-t_c)D}{E+(1-t_c)D}$$

  - This is correct when the company you are levering/unlevering maintains a fixed amount of debt
  - The idea behind this formula is that the ITS does not contribute to firm risk

Flow-to-Equity (FTE) Method

- Flow-to-Equity (FTE) valuation:
  1. Calculate the **Free Cash Flow to Equity (FCFE)**, by adjusting FCF for *all cash flows to and from debt-holders*
     - $FCFE_t = (EBIT_t - Interest_t) * (1 - t_c) + Dept_t - Capex_t - \Delta NWC_t + \Delta NetDebt_t$
     - Two components of cash flows to debt holders:
       - Interest payments
       - Net borrowing (debt issuance minus debt repayments)
  2. Discount FCFE using the equity cost of capital to get the equity value
- Similar idea as dividend discount/total payout model, with the exception that we're discounting cash flows *available to equity* rather than payouts (which depends on these available cash flows *plus payout policy*)

Calculating FCFE (an example from the book)

	Year	0	1	2	3	4
Incremental Earnings Forecast ($ million)						
1	Sales	—	60.00	60.00	60.00	60.00
2	Cost of Goods Sold	—	(25.00)	(25.00)	(25.00)	(25.00)
3	**Gross Profit**	—	35.00	35.00	35.00	35.00
4	Operating Expenses	(6.67)	(9.00)	(9.00)	(9.00)	(9.00)
5	Depreciation	—	(6.00)	(6.00)	(6.00)	(6.00)
6	**EBIT**	(6.67)	20.00	20.00	20.00	20.00
7	Interest Expense	—	(1.84)	(1.42)	(0.98)	(0.51)
8	**Pretax Income**	(6.67)	18.16	18.58	19.02	19.49
9	Income Tax at 40%	2.67	(7.27)	(7.43)	(7.61)	(7.80)
10	**Net Income**	(4.00)	10.90	11.15	11.41	11.70
Free Cash Flow to Equity						
11	Plus: Depreciation	—	6.00	6.00	6.00	6.00
12	Less: Capital Expenditures	(24.00)	—	—	—	—
13	Less: Increases in NWC	—	—	—	—	—
14	Plus: Net Borrowing	30.62	(6.92)	(7.39)	(7.89)	(8.43)
15	**Free Cash Flow to Equity**	**2.62**	**9.98**	**9.76**	**9.52**	**9.27**

Calculating FCFE (cont.)

- Note that:
  - Interest expenses are deducted before taxes (*i.e.*, we don't do EBIT*(1-t) here)
  - The net proceeds from the firm's **net borrowing** activity are added in:

$$NetBorrowing_t = D_t - D_{t-1}$$

(These proceeds are positive when the firm issues debt and negative when the firm reduces its debt by repaying principal)

- The FCFE can alternatively be calculated based on FCF as :

$$FCFE = FCF - (1 - t_c) * (\text{Interest}) + \Delta\text{NetDebt},$$

where $(1 - t_c) * (\text{InterestPayments})$ is the after-tax interest expense

Recall our Frozen Treat Example?

- Project has D/V=40%, $r_d = 5\%$, and $r_e = 12\%$
  - So with a 12.5m project value, E=7.5m and D=5m
- The cash flows are allocated as follows:
  - Debtholders receive 5% x \$5m = \$.25m
  - Taxes paid are (\$1.535m - \$.25m) x 30% = \$.385m
  - Shareholders get the rest: 1.535m - .25m - .385m = \$.90m
  - (note that we continue to assume here that future capex, depreciation, NWC, are 0, and there is also no change in debt levels)
- NPV (to equity) = -7.5m + 0.90m/12% = 0
  - Recall: 7.5m is the equity investment

Why use the Flow-to-Equity Method?

- Simpler to use if the firm's capital structure is complex and the market values of other securities in the firm's capital structure are not known, but we know their cash flows
  - E.g., if the firm has hard-to-value convertible or preferred securities, etc.
- Explicitly reflects project's implications for shareholders, which is what equity investors mainly care about
- But, as with APV, a bit more complicated than the WACC method since we must explicitly forecast future net borrowing and interest payments