Corporate Finance

Lecture 10: Valuation & Capital Budgeting for Levered Firms

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Outlines

Three approaches to value levered firms/projects

Applicational details of the WACC approach

- Unlever-Lever

Divisional cost of capital

- Pure play

Valuation for Levered Firms

Valuation in presence of debt financing:

- **Adjusted Present Value Approach**
- **Flows to Equity Approach**
- **Weighted Average Cost of Capital Approach**

Same foundation: *Discount Cash Flow*

- Match cash flows with the proper discount rate

Same valuation approaches apply to capital budgeting.

1. Adjusted Present Value

$$APV = NPVU + NPVF$$

- The value of a project to the firm can be thought of as *the value of the project to an unlevered firm (NPVU)* plus the *present value of the financing side effects (NPVF).*
- There are four **side effects of financing**:
  - The *Tax* Shield of Debt
  - The Costs of *Issuing* New Securities (flotation costs)
  - The Costs of Financial *Distress*
  - *Subsidies* to Debt Financing (borrow at tax-free rate from government)

2. Flow to Equity Approach

- Discount the *cash flow* from the project *to the* *equity holders* of the levered firm at the cost of *levered equity capital,* r_E.
- There are three steps in the FTE Approach:
  - Step One: Calculate the levered cash flows (LCFs)
    - LCF = PCF – *After-tax* Interest Expenses
    - Recall: PCF=(S-C-D)x(1-t)+D-Capex-ΔNWC
  - Step Two: Calculate r_E.
  - Step Three: Value the levered cash flows at r_E.

3. WACC Approach

$$WACC = \frac{D}{V} \cdot (1 - \tau) \cdot r_D + \frac{E}{V} \cdot r_E$$

- To find the value of the project, discount the *unlevered cash flows (free cash flow)* at the *weighted average cost of capital*.
- In practice, the WACC Approach, by far, is the *most widely* used valuation method.

Example: Three Approaches

Consider a project of the Pearson Company. The timing and size of the incremental *after-tax cash flows* for an all-equity firm are:

–$1,000	$100	$100	$100	$100…
0	*1*	*2*	*3*	*4…*

The *unlevered cost of equity* is r_A= 10%.

Project NPV for all-equity firm is $-\$1{,}000 + \frac{\$100}{10\%} = \$0.$

Example: 1. APV Approach

- Now, imagine the firm finances the project with \$600 of permanent debt at $r_D = 8\%$.
- Pearson's tax rate is 40%, so they have an interest tax shield worth $\tau D = 0.4 \times \$600 = \$240$.
- The net present value of the project under leverage is:
- $APV = NPVU + NPVF = \$0 + \$240 = \$240$.
- So, Pearson should accept the project *with debt*.

Example: 2. FTE Approach

Step One: Calculate the levered cash flows (LCFs)

- Since the firm is using \$600 of debt, the equity holders only have to provide \$400 of the initial \$1,000 investment.
- Thus, the initial cash flow to equity holders is $CF_0 = -\$400$.
- Each period, the equity holder must pay interest expense. The *after-tax interest expense* is $\$600 \times 8\% \times (1 - 0.4) = \$28.8$.
- Thus, the levered cash flow of each period is $\$100 - \$28.8 = \$71.2$

Example: 2. FTE Approach

Step Two: Calculate r_E

- First, the debt ratio of the project：
  - $V = \frac{\$100}{10\%} + 240 = 1240$;
  - $\frac{D}{E} = \frac{600}{1240-600}$=0.9375
- Then, apply $\boxed{\text{M\&M\#2: } r_E = r_A + \frac{D}{E}(1-\tau)(r_A - r_D)}$
- $r_E = 10\% + 0.9375 \times (1 - 0.4) \times (10\% - 8\%) = 11.125\%$

Step Three: Value the levered cash flows at r_E

- $NPV = -\$400 + \frac{\$71.2}{11.125\%} = \$240$

Example: 3. WACC Approach

- First, find: $WACC = \frac{D}{V} \cdot (1 - \tau) \cdot r_D + \frac{E}{V} \cdot r_E$.

- $WACC = \frac{600}{1240} \times (1 - 0.4) \times 8\% + \frac{640}{1240} \times 11.125\% = 8.0645\%$

- To find the value of the project, discount the ***unlevered cash flows*** at the weighted average cost of capital.

- $NPV = -\$1000 + \frac{\$100}{8.0645\%} = \$240.$

Summary of Three Approaches

- 1. $APV = \sum_{t=1}^{\infty} \frac{UCF_t}{(1+r_A)^t} - I_0 + NPV_F,$
  - where I_0 is the initial investment, and NPV_F is the additional value impact of debt.
- 2. $NPV_{FTE} = \sum_{t=1}^{\infty} \frac{LCF_t}{(1+r_E)^t} - (I_0 - D_0),$
  - where I_0 is the initial investment, and D_0 is the amount borrowed.
- 3. $NPV_{wacc} = \sum_{t=1}^{\infty} \frac{UCF_t}{(1+wacc)^t} - I_0$

Applications

- Three approaches can also be applied to capital budgeting problems for the projects with non-perpetual cash flows.
  - They might not give the exact same valuation.
- WACC is the most commonly used by far.
- FTE has appeal for a firm deeply in debt.
- APV is used if the level of debt is known over the project's life.
  - APV is frequently used for special situations like LBOs and leases.

Details of Estimating WACC

- For capital budgeting decisions, we care about the *expected WACC* going forward.
- How to estimate WACC?
  - $WACC = \frac{D}{V} \cdot (1 - \tau) \cdot r_D + \frac{E}{V} \cdot r_E$
  - We need to know the expected return on equity, expected return on debt, and *expected capital structures*.
  - Tax rates:
    - If you are a passive analyst, use firm's current tax rate
    - If you are a decision maker, use *marginal* rather than average tax rate

1. At Target Capital Structure

When the company is close to the target capital structure:

- One can directly plug the *current debt ratios* into the WACC formula.
- For the cost of equity, one can apply the CAPM:

$$E(r_E) = r_f + \beta_E(r_m - r_f)$$

  - where β_E is usually estimated from the recent stock returns.

1. At Target Capital Structure

- The **cost of debt** can be represented by the ***yield-to-maturity*** of corporate bonds outstanding.
- If the company has no bonds trading, one could look for the YTM of a company with ***similar default risk*** in the same industry.
- *Default risk* could be measured using ***Altman's Z-score***, given by the following formula:

Z = 0.012*(Working Capital/Total Assets) + 0.014*(Retained Earnings/Total Assets) + 0.033*(EBIT/ Total Assets) + 0.006*(Market Value of Equity/ Book Value of Total Liabilities) + 0.009*(Sales/ Total Assets).

2. Changing Capital Structure

- However, if the ***recent*** capital structure is very ***different*** from the ***target*** capital structure, then other methods are needed.
- This is because the ***beta of equity*** *that we estimate at today's capital structure* will be very different from its value *at the target capital structure*.
  - Implicit assumption: capital structure converges to the target level in the near future.
  - Thus, the cost of equity we estimate using current beta will be very different than when the debt ratio is at the target level.

2. Changing Capital Structure

- We can adopt the concept of expected return of unlevered equity, $E(r_A)$.
- Recall:

$$WACC = r_A \cdot (1 - \tau \cdot \frac{D}{V})$$

- If we know expected r_A and the target level of $\frac{D}{V}$, we can find out WACC under the target capital structure.

Unlever-Relever Approach

1. Estimate r_E and r_D under current capital structure
   - r_E usually by estimating β_E using recent past returns and applying CAPM
   - r_D usually using the average interest rate of current debts; if no debt outstanding, using the interest rate of comparable firms
2. **Un-lever**: find r_A according to M&M#2
   - $r_E = r_A + \frac{D}{E}(1-\tau)(r_A - r_D)$
   - Note D/E is the current leverage ratio
3. **Re-lever**: find WACC under the new capital structure
   - $WACC = r_A \cdot (1 - \tau \cdot \left(\frac{D}{V}\right)')$
   - Or, $r_E' = r_A + \left(\frac{D}{E}\right)'(1-\tau)(r_A - r_D)$ and $WACC = \left(\frac{E}{V}\right)' r_E' + \left(\frac{D}{V}\right)' r_D(1-\tau)$
   - Note (D/E)' or (D/V)' refer to the new capital structure