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**VALUATION MODELS**

This section deals with the basic theory underlying valuation of a project. It begins by discussing three approaches to valuations:

1. **Weighted Average Cost of Capital** **(WACC)**
2. **Adjusted-Present Value (APV)**
3. **Cash Flow-To-Equity** **(CFTE)** method.

The value is merely the present value of the expected cash flows discounted at a rate appropriate to the riskiness of the cash flow being discounted.

**1. TRADITIONAL CAPITAL BUDGETING TECHNIQUES:**

The traditional capital budgeting techniques involve the unlevered cash flows to be discounted by the weighted average cost of capital.



where the cost of capital is equal to:



and the unlevered cash flow (UCF) is estimated as:

**Unlevered Free Cash Flow=**

EBIT

Less: Cash Taxes on EBIT

Plus: Depreciation and Amortization

Less: Increase in Net Working Capital

Less: Investment in Capital Expenditure

Less: Increase in other operating assets

Reduced by increase in other non-

interest bearing liabilities

= Unlevered Cash Flow (UCF)

**Note: A. Cash flows do not include the tax benefits of debt.**

**B. Discount rate (WACC) includes the tax benefits of debt.**

**2. ADJUSTED PRESENT VALUE:**

This is another technique of valuing a project. With this method the value of the project is simply the summation of the present value of expected unlevered free cash flows and the present value of tax benefit due to the amount of debt used to finance the project. This method should be used when the debt ratio is expected to change but the amount of debt outstanding is known over the life of the project.





In this method the value of the firm is from two parts: the value as all equity firm plus any incremental value from leverage.

In a strict MM world, we have: VL = VU + TC x (D)

Once again, APV method is a preferred method when the level of debt is known over the life of the project.

**CASH FLOW TO EQUITY:**

In addition to valuing an entire a project, an alternative to other two methods, is cash flow-to-equity (CFTE). This approach directly values the cash flows to common equity holders. The cash flow for this method can be calculated by subtracting after-tax interest payment from unlevered cash flow (UCF). That is:



where D is the amount borrowed and **LCF = UCF - (1- TC)(rd)D**

**Levered Free Cash Flow (CFTE) Method:**

EBIT

Less: Interest Payment

Less: Cash Taxes on EBIT

Plus: Depreciation and Amortization

Less: Increase in Net Working Capital

Less: Investment in Capital Expenditure

Less: Increase in other operating assets

Reduced by increase in other non-

Interest bearing liabilities

Less: New debt issued minus debt repayments

**= Levered Cash Flow (LCF)**

The discount rate to use is the levered cost of equity



or using CAPM method:

where 

**Conclusion**- we can use **CFTE** under same circumstances when we use **WACC**; i.e. when debt to capital ratio is constant. WACC method is easier to use than CFTE.

**EXAMPLE**

Consider a project to produce solar water heaters. It requires a $10 million investment and offers a level EBIT of $3 million per year for 10 years. The opportunity cost of capital is 12 percent, which reflects the project's business risk. The tax rate is 40%.

The NPV method begins by valuing the project as if it were a mini-firm financed solely by equity. Thus, the base-case NPV is



In a pure MM world where financing decision don’t matter, the financial manager would consider the project, even though, the NPV value of $170,000 is not significant. However, if the firm had to finance the $10 million project by equity or debt, the decision to take the investment would change drastically. If the equity issue cost (flotation cost) 5% of the proceed, then the NPV would be negative.

**NPV = NPVBase-case - flotation cost**

NPV = $170,000 - 526,316 = -$356,316

The firm would reject the project because NPV is negative.

The flotation cost is estimated as follows:

New Equity = Amount needed/ (1 - FC)

= $5,000,000/ (1 - 5%) = $10,526,316

FC =10,526,316 - 10,000,000 = 526,316

**Additions to the Firm’s Debt Capacity**

Consider the case where the company decides to finance 50% of the funds by debt. Assume that this $5 million is amortized over itself life. Assume also that the loan has an 8% interest rate. Table 1 shows how the value of the interest tax shield is calculated.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table 1  Calculating the present value of interest tax shields on debt | | | | | |  |
| **Year** | **Debt Outstanding at Start of Year** | **Annual Payment** | **Interest** | **Debt Retirement** | **Interest Tax Shields** | **Present Value of Tax Shields** |
| 1 | 5,000,000 | $745,147.44 | 400000.00 | 345147.44 | 160000 | $148,148 |
| 2 | 4,654,853 | $745,147.44 | 372388.20 | 372759.24 | 148955.28 | $127,705 |
| 3 | 4,282,093 | $745,147.44 | 342567.47 | 402579.97 | 137026.99 | $108,776 |
| 4 | 3,879,513 | $745,147.44 | 310361.07 | 434786.37 | 124144.43 | $91,250 |
| 5 | 3,444,727 | $745,147.44 | 275578.16 | 469569.28 | 110231.26 | $75,022 |
| 6 | 2,975,158 | $745,147.44 | 238012.61 | 507134.83 | 95205.05 | $59,995 |
| 7 | 2,468,023 | $745,147.44 | 197441.83 | 547705.61 | 78976.73 | $46,082 |
| 8 | 1,920,317 | $745,147.44 | 153625.38 | 591522.06 | 61450.15 | $33,200 |
| 9 | 1,328,795 | $745,147.44 | 106303.61 | 638843.83 | 42521.45 | $21,271 |
| 10 | 689,951 | $745,147.44 | 55196.11 | 689951.00 | 22078.44 | $10,227 |
|  | **Total** | **$7,451,474.43** | **2451474.43** | 5000000 | 980589.77 | **$721,676** |

We obtain APV by adding the value of interest tax shields, $721,676.14, to the base-case NPV:

APV = NPVBase-case + PV (tax shields)-Flotation Cost

APV = +170,000+ 721676 - 263158= $628,518

**Cash Flow-to- Equity:**

Column 6 of Table 2 shows the cash flow from the project to the equity holders of the levered firm.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **1**  **Year** | **2**  **Cash Flow** | **3**  **Interest** | **4**  **Earnings Before Tax** | **5**  **Tax Payment** | **Debt Retirement** | **6**  **Levered Cash Flow** | **7**  **Present value**  **Cash Flow** |
| 1 | 3,000,000 | 400000.00 | 2,600,000 | 1040000 | 345147.44 | 1,241,853 | $1,061,934 |
| 2 | 3,000,000 | 372388.20 | 2,627,612 | 1051044.72 | 372759.24 | 1,203,808 | $919,625 |
| 3 | 3,000,000 | 342567.47 | 2,657,433 | 1062973.01 | 402579.97 | 1,191,880 | $796,076 |
| 4 | 3,000,000 | 310361.07 | 2,689,639 | 1075855.57 | 434786.37 | 1,178,997 | $688,349 |
| 5 | 3,000,000 | 275578.16 | 2,724,422 | 1089768.74 | 469569.28 | 1,165,084 | $594,603 |
| 6 | 3,000,000 | 238012.61 | 2,761,987 | 1104794.96 | 507134.83 | 1,150,058 | $513,054 |
| 7 | 3,000,000 | 197441.83 | 2,802,558 | 1121023.27 | 547705.61 | 1,133,829 | $442,146 |
| 8 | 3,000,000 | 153625.38 | 2,846,375 | 1138549.85 | 591522.06 | 1,116,303 | $380,517 |
| 9 | 3,000,000 | 106303.61 | 2,893,696 | 1157478.56 | 638843.83 | 1,097,374 | $326,979 |
| 10 | 3,000,000 | 55196.11 | 2,944,804 | 1177921.56 | 689951.00 | 1,076,931 | $280,497 |
|  |  |  |  |  |  | **Total** | **$6,003,779** |

The present value of the levered cash flow is shown in column 7 that is calculated by discount rate of 14.4%. The discount rate is calculated as follow:



NPVCFTE = 6,003,779 - 5,000,000 -263158= $740,621

**Weighted-Average-Cost-of-Capital Method**

Finally, we can value the project using the **weighted average cost** **of capital (rWACC)** method**.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Cash Flow** | **After tax cash flow** | **Present value (UFCF)** |
| 1 | 3,000,000 | 1,800,000 | $1,642,336 |
| 2 | 3,000,000 | 1,800,000 | $1,498,482 |
| 3 | 3,000,000 | 1,800,000 | $1,367,228 |
| 4 | 3,000,000 | 1,800,000 | $1,247,471 |
| 5 | 3,000,000 | 1,800,000 | $1,138,203 |
| 6 | 3,000,000 | 1,800,000 | $1,038,506 |
| 7 | 3,000,000 | 1,800,000 | $947,542 |
| 8 | 3,000,000 | 1,800,000 | $864,546 |
| 9 | 3,000,000 | 1,800,000 | $788,819 |
| 10 | 3,000,000 | 1,800,000 | $719,726 |
|  |  |  | **$11,252,858** |

The formula for determining the rWACC is



The NPVWACC is:

NPVWACC = 11,252,858 - 10,000,000-263158 = $989,700