Valuation APV WACC and Target Capital Structure with Constant Free Cash Flows

Consider a company with invested capital of $3000, earnings before interest and taxes (EBIT) of $600, and beta (*β*u) of the assets = 1.00; initial debt (D), with a beta (*β*d) of 0.3, is set at $200, and the corporate tax rate, TC, is 34%. We assume that the capital asset pricing model applies, with a risk-free rate, *R*f, = 5.0% and market risk premium, MRP = 6.0%. Therefore, the required return on assets, (unlevered cost of capital) is 11.0 %, (the cost of *unlevered* equity is the return shareholders would require if the assets were 100% equity financed) and the cost of debt, Rd, is 7.5%. We also assume an expected growth rate of 0% and that debt remains constant overtime at $200 and the company has $132 in cash and 300 shares outstanding.

**Base Case: Adjusted Present Value (APV) Assuming the Debt Level Is Constant over Time**

Discounting the free cash flows to the firm (FCFFs) and the terminal value of the FCFFs (FCFF4/Ru) at unlevered cost of equity, and tax shield (TS) and terminal value of the tax shield (TS4/ Rd) discounted at cost of debt, the enterprise value (EV) is estimated.

Note that using Rd to discount the tax shields does not imply that the tax shields are assumed to be riskless, but, as in Modigliani and Miller’s seminal paper, they are assumed to carry the same risk as the debt itself.

Table 1 shows that Adjusted Present Value (APV) valuation of MM capital structure yields an enterprise value (EV) of $3,668, market value of equity (MVE) of $3,600 and stock price of $12 per share.

**Table 1. Adjusted present value (APV) valuation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  Table -1 | *Year* | *1* | *2* | *3* | *4* |
| Growth |   | 0% | 0% | 0% | 0% |
| EBIT |   | $600 | $600 | $600 |   |
| Tax (34%) | 34% | -$204 | -$204 | -$204 |   |
| Net Income |   | $396 | $396 | $396 |   |
| Plus: Dep |   | $0 | $0 | $0 |   |
| Less: Investment in NWC |   | $0 | $0 | $0 |   |
| Less; Net Cap EXP |   | $0 | $0 | $0 |   |
| Free Cash Flow |   | $396 | $396 | $396 |   |
| Discount factor @ Ru (11.0%) | 11% | 90.1% | 81.2% | 73.1% |   |
| PV of FCF |   | $357 | $321 | $290 |   |
| Total FCF | $968  |   |   |   |   |
| Terminal Value |   |   |   |   | $3,600 |
| PV(TV) | $2,632 |   |   |   |   |
| Market value of unlevered firm | $3,600 |   |   |   |   |
| Debt |   | $200 | $200 | $200 | $200 |
| Interest @ Rd (7.50%) | 7.50% | $15 | $15 | $15 | $15 |
| TV(TS) |   |   |   |   | $68 |
| Tax shields @ tax rate (.34%) |   | $5.10 | $5.10 | $5.10 |   |
| PV(TS) | $13.26  |   |   |   |   |
| PV (TV of TS) | $54.74  |   |   |   |   |
| Value of Tax Shield | $68 |   |   |   |   |
| Enterprise value (EV) | $3,668 |   |   |   |   |
| Cash | $132 |   |   |   |   |
| Debt | $200 |   |   |   |   |
| Market value of equity (MVE) | $3,600 |   |   |   |   |
| Shares | 300 |   |   |   |   |
| Price | $12.00 |   |   |   |   |

Alternate Solution: MVE = Price x Shares = $12 x 300 =$36,00

VLevered = VUnlevered + Tax rate (Debt) = $3600 + 34% ($200) = $3,668

**WACC Approach**

Table 2 shows that WACC valuation yields the same result as APV, with FCFF now discounted at WACC = 11.0% and residual value at the end of the third year equaling FCFF4/WACC. The WACC computation, and therefore the equivalence between the two methodologies, depends critically on the cost of equity being consistent with the arbitrage-implied structure of return requirements. In the case of debt remaining constant over time, the classical formula used by practitioners applies: Re = *R*f + *β*e (MRP)

and *β*e = *β*u[1 + (1 – TC) × D/E]

with computation of D/E based on the debt of $200 and the enterprise value of $3800 implied by the APV valuation. The latter formula is the one that prevails in a Modigliani–Miller setting in a world *with* taxes. In this case *β*e =1.05 and Re = 11.30% and WACC of 11%.

**Table 2. Weighted average cost of capital (WACC) valuation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | *Year* | *1* | *2* | *3* | *4* |
| Growth |   | 0% | 0% | 0% | 0% |
| FCFF |   | $396 | $396 | $396 |   |
| WACC |   | 11.00% | 11.00% | 11.00% | 11.00% |
| Discount factor @ WACC |   | 0.9009 | 0.8117 | 0.7313 |   |
| PV of FCF |   | $357 | $321 | $290 |   |
| Total FCF | $967.77 |   |   |   |   |
| Terminal Value |   |   |   |   | $3,601 |
| PV(TV) | $2,633 |   |   |   |   |
| Market value of levered firm | $3,601 |   |   |   |   |
| Debt | $200 |   |   |   |   |
| CASH | $132 |   |   |   |   |
| Market value of equity (MVE) | $3,601 |   |   |   |   |
| Price per share | $12.00 |   |   |   |   |

**APV with Debt Varies with the Value of the Assets- Impact on the Discount Rates**

Continue to assume an expected growth of 0%, but now replace the assumption that the firm will maintain a fixed debt level equal to $200 over time by the assumption that it will maintain a constant proportion of debt to enterprise value (D/V) equal to 20%.

The result is as follows:

Tax shield beyond year 1 are now a function of the actual debt levels realized in the future, which are themselves a function of the actual free cash flows. This implies that tax shields beyond year 1 have the same probability distribution, and therefore the same risk, as the value of the assets. Therefore, from year 2 onwards an APV valuation now needs to discount tax shields at the rate Ru, which reflects the risk of the assets, rather than at the cost of debt, Rd.

Equity is no longer partially protected in a downturn by a fixed level of the tax shield, since the latter adjusts to the lower value of the assets; it benefits more than before in an upturn, but, given investors’ risk-aversion, this does not compensate. As a result, equity holders now require a higher return, Re. The Re can be derived using the following formula:

Re **=***R***f +***β***e (**MRP**)**

and *β***e =***β*u [**(**1 + (D/E**)]** with computation of D/V based on the target D/V ratio of 20%. In this case *β*e = 1.25 and Re = 12.5% and WACC of 10.49%. Note that the formula for the *β*e computation is no longer the same as before but is now identical to the one which would prevail in a Modigliani–Miller setting in a world *without* taxes.

**Impact on Valuation**

Table 3 shows APV valuation. Applying the D/EV target ratio of 20% yields D = $733.6 with Enterprise Value (EV) of 3668, and market value of equity (MVE) is 33173, lower than when debt is assumed to remain constant even though *expected* debt is assumed to remain constant. FCFFs and the terminal value of the FCFFs, discounted at Ru, yield the same value as before, but tax shields (TS), as well as the terminal value of the tax shields (equal to TS4/Ru), are now discounted at Rd for one year only and at Ru thereafter, which yields a lower overall value of the tax shields.

WACC based on target capital structure

**Table 3. Adjusted present value (APV) valuation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Valuation Based on target Capital Structure | *Year* | *1* | *2* | *3* | *4* |
| Growth |   | 0% | 0% | 0% | 0% |
| FCFF |   | $396 | $396 | $396 |   |
| WACC |   | 10.49% | 10.49% | 10.49% | 10.49% |
| Discount factor @ WACC |   | 0.9051 | 0.8191 | 0.7414 |   |
| PV of FCF |   | $358 | $324 | $294 |   |
| Total FCF | $976.36 |   |   |   |   |
| Terminal Value |   |   |   |   | $3,775 |
| PV(TV) | $2,799 |   |   |   |   |
| Market value of levered firm | $3,775 |   |   |   |   |
| Debt | $200 |   |   |   |   |
| CASH | $132 |   |   |   |   |
| Market value of equity (MVE) | $3,775 |   |   |   |   |
| Price per share | $12.58 |   |   |   |   |

|  |
| --- |
| Computation of WACC based on Target D/V=20% |
| Unlevered Beta | 1 | D/V | 0.2 |
| Debt Beta | 0.3 | E/V | 0.8 |
| *β*e = *β*u[1 + D/E] | Levered Beta | 1.250 |   |
|   |   |   |   |
| Tax rate | 34.0% |   |   |
| Levered Beta | 1.25 |   |   |
| Levered cost of equity | 12.5% |   |   |
| Cost of Debt | 7.50% |   |   |
| WACC | 10.49% |   |   |
|

|  |
| --- |
|   |

 |   |   |   |
|   |   |   |   |
|   |   |   |   |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Valuation Based on WACC When Debt Varies with FCF | *Year* | *1* | *2* | *3* | *4* |
| Growth |   | 0% | 0% | 0% | 0% |
| FCFF |   | $396 | $396 | $396 |   |
| WACC |   | 10.86% | 10.86% | 10.86% | 10.86% |
| Discount factor @ WACC |   | 0.9021 | 0.8137 | 0.7341 |   |
| PV of FCF |   | $357 | $322 | $291 |   |
| Total FCF | $970.15 |   |   |   |   |
| Terminal Value |   |   |   |   | $3,648 |
| PV(TV) | $2,678 |   |   |   |   |
| Market value of levered firm | $3,648 |   |   |   |   |
| Debt | $200 |   |   |   |   |
| CASH | $132 |   |   |   |   |
| Market value of equity (MVE) | $3,648 |   |   |   |   |
| Price per share | $12.16 |   |   |   |   |

|  |
| --- |
| Computation of WACC When D/E Changes |
| Unlevered Beta | 1 |
| Debt Beta | 0.3 |
| Levered Beta | 1.037 |
| Debt | $200 |
| equity | $3,600 |
| V=D+E | $3,800 |
| D/E | 5.26% |
| Tax rate | 34.00% |
| Levered Beta | 1.04 |
| *Levered cost of equity* | 11.2% |
| Cost of Debt | 7.50% |
| WACC | 10.86% |