Corporate Finance 1 - Formeln

20. Februar 2011

Inhaltsverzeichnis

Don't Panic

(Douglas Adams: The Hitchhiker's Guide to the Galaxy*)*

1 Basics

1.1 Various firm characterizing formula

$$\begin{aligned}
\text{Owners' Equity} &= \text{Assets} - \text{Liabilities} \\
\text{Enterprise Value (EV)} &= \text{Equity Value} + \text{Net Debt} + \text{Minorities} \\
\text{Net Debt} &= \text{Debt} - (\text{Cash} + \text{Cash Equivalents}) \\
\text{Equity Value} &= \text{Market Capitalization} \\
&= \text{Number of shares outstanding} * \text{Price per share} \\
\text{Price-Earnings Ratio P/E} &= \frac{\text{Share Price}}{\text{Earnings per Share}} = \frac{\text{Equity Value}}{\text{Earnings}}
\end{aligned}$$

Cash equivalents are so called marketable securities, e.g. certificates of deposit, money market funds, government bills, and commercial paper.

The market-to-book ratio (MTB) is the ratio of a firm's market capitalization to its book value of stockholders' equity.

$$MTB = \frac{\text{Market Value of Equity}}{\text{Book Value of Equity}}$$

The debt-equity ratio (D/E) is the ratio of a firm's debt value to its equity value. It can be calculated using either book or market values for equity and debt.

$$D/E = \frac{\text{Total Debt}}{\text{Total Equity}}$$

$$\text{Payout Ratio} = \frac{\text{Dividends}}{\text{Net Income}}$$

$$\text{Retained Earnings} = \text{Net Income} - \text{Dividends}$$

$$\text{Return on Equity (ROE)} = \frac{\text{Net Income}}{\textbf{Book}\text{Value of Equity}}$$

$$\text{Earnings per Share (EPS)} = \frac{\text{Net Income}}{\text{Shares outstanding}}$$

Standard EPS, Diluted EPS (Standard EPS mit allen Aktienoptionen)

- Operating activities

- Investing activities
- Financing activities

The margin reveals how much a company earns before interest and taxes from each dollar of sales.

$$\text{Operating Margin} = \frac{\text{Operating Income}}{\text{Total Sales}}$$

The margin shows the fraction of each dollar in revenues that is available to equity holders after the firm pays interest and taxes.

$$\text{Net Profit Margin} = \frac{\text{Net Income}}{\text{Total Sales}}$$

1.2 Income Statement

Example Income Statement	
	Total Sales
−	Cost of sales
=	**Gross profit**
−	Selling, general and administrative expenses
−	Research and development
−	Depreciation and amortization
=	**Operating Income**
−	Other Income
=	**Earnings before interest and taxes (EBIT)**
−	Interest expense
=	**Pretax income**
−	Taxes
=	**Net Income**

1.3 Balance sheet after merger

	Example Balance Sheet after Merger	
	Current assets	
	Fixed assets	
	Goodwill	Difference between total assets and total EV
=	**Total assets**	
	Debt	
	Equity	= Purchase price
=	**Total EV**	

Use market values for balance sheet. Total assets and total EV must be equal, difference will be accounted for in „Goodwill“.

2 Free Cash Flows - EFCF / PFCF

Equity free cash flow (EFCF): Cash flow available for distribution to the firm's common shareholders.

$$\begin{aligned}\text{EFCF}_{\text{Unlevered Firm}} &= \text{EBIT} * (1 - \text{T}) + \text{DA} - \text{CAPEX} - \Delta\text{NWC} \\ \text{EFCF}_{\text{Levered Firm}} &= (\text{EBIT} - \text{I})(1 - \text{T}) + \text{DA} - \text{CAPEX} - \Delta\text{NWC} - \text{P} + \text{NP} \\ &= \text{Net Income} + \text{DA} - \text{CAPEX} - \Delta\text{NWC} - \text{P} + \text{NP}\end{aligned}$$

Project free cash flow (PFCF): Cash flows available for distribution to both the firm's creditors and equity holders.

$$\text{PFCF} = \text{EBIT} * (1 - \text{T}) + \text{DA} - \text{CAPEX} - \Delta\text{NWC}$$

- **EBIT**: Earnings before interest and taxes
- **EBIT * (1 - T)**: After-tax operating income or net operating profit after tax (NOPAT)
- **EBIT - I**: Earnings before Taxes (EBT)
- **(EBIT - I) * (1 - T)**: Net income after taxes (EAT)
- **I**: Interest
- **T**: Tax rate
- **DA**: Depreciation and amortization expense
- **ΔNWC**: Change in net working capital
- **CAPEX**: Capital expenditures for property, plant, and equipment; Change of PPE
- **P**: Principal payments on the firm's outstanding debt
- **NP**: Net proceeds from the issuance of new debt

$$\begin{aligned}\text{NWC} = &\left[\begin{pmatrix}\text{Current}\\ \text{Assets}\end{pmatrix} - \begin{pmatrix}\text{Cash and Marketable}\\ \text{Securities}\end{pmatrix}\right] \\ &- \left[\begin{pmatrix}\text{Current}\\ \text{Liabilities}\end{pmatrix} - \begin{pmatrix}\text{Current Portion of}\\ \text{Interest-Bearing Debt/Notes}\end{pmatrix}\right]\end{aligned}$$

3 Discounted Cash Flow - DCF

$$\text{Net Present Value (NPV)} = \sum_{t=0}^{T} [\text{PV}(\text{Cash Inflows}_t) - \text{PV}(\text{Cash Outflows}_t)]$$

$$\text{Investment Rate (IR)} = \frac{\text{Net Investment}}{\text{NOPAT}}$$

$$\text{Return on Invested Capital (ROIC)} = \frac{\text{NOPAT}}{\text{Invested Capital}}$$

$$\text{PV of Perpetuity} = \frac{\text{Cash Flow}}{\text{r}}$$

$$\text{PV of Growing Perpetuity} = \frac{\text{Cash Flow}}{\text{r} - \text{g}}$$

$$\text{PV of Firm with constant growth } \text{V}_t = \frac{\text{FFCF}_{t+1}}{\text{WACC} - \text{g}} = \frac{\text{FFCF}_t * (1 + \text{g})}{\text{WACC} - \text{g}}$$

Net Investment: Change in invested capital from one period to the next

4 Weighted Average Cost of Capital - WACC

$$\text{WACC} = \text{k}_d * \text{w}_d * (1 - \text{T}) + \text{k}_p * \text{w}_p + \text{k}_e * \text{w}_e$$

It is the average of the estimated required rates of return for the firm's interest-bearing debt (k_d), preferred stock (k_p), and common equity (k_e). The weights used for each source of funds are equal to the proportions in which funds are raised.

4.1 Cost of Debt Capital (k_d)

The best estimate of a firm's current cost of debt is the yield to maturity (YTM) on its publicly-traded bonds.

Promised YTM: No default risk
Expected YTM: Interest and principal payments are subject to default risk

If credit rating is in the investment grade range (better than BB) use promised YTM, else use expected YTM. If firm has no publicly traded debt (no bonds outstanding) estimate the cost of debt by adding a rating-oriented credit risk spread to the yield of an (risk-free) government bond.

4.2 Cost of Preferred Equity (k_p)

$$\mathrm{k}_p = \frac{\text{Preferred Dividend}}{\text{Preferred Stock Price}}$$

If not considered separately, preferred stock is typically included in debt.

4.3 Cost of Common Equity (k_e)

$$\begin{aligned}
\mathrm{k}_e &= \mathrm{r}_f + \beta_e * (\mathrm{R}_{Market} - \mathrm{r}_f) \\
\beta_u &= \frac{\beta_e}{1 + (1 - \mathrm{T}) * \frac{D}{E}} \\
\beta_e &= \beta_u * (1 + (1 - \mathrm{T}) * \frac{D}{E}) - \beta_{\text{debt}} * (1 - T) * \frac{D}{E}
\end{aligned}$$

- $\mathbf{r_f}$: Risk free rate of interest
- $\boldsymbol{\beta_e}$: Beta of company, or systematic risk of company common equity
- $\mathbf{R_{Market}}$: Expected return on the market portfolio (all risky assets)
- $(\mathbf{R_{Market}} - \mathbf{r_f})$: Expected equity risk premium

If β_{debt} is not given, calculate with CAPM:

$$\mathrm{k}_d = \mathrm{r}_f + \beta_d * (\mathrm{R}_{Market} - \mathrm{r}_f)$$

Unsystematic risk can be eliminated through portfolio diversification. If applicable add company size premium to cost of equity.

$$\text{Standard deviation } \sigma_x = \sqrt{\text{Var(x)}}$$

$$\beta_{\text{Firm}} = \frac{\text{Cov(Firm, Index)}}{\text{Var(Index)}}$$

5 Divisional WACC

Comparison Divisional WACC - Single companywide WACC:

Divisional WACC lower than companywide WACC tends to under-invest in division, higher than companywide WACC tends to over-invest.

Project Debt capacity: Amount of additional debt the firm can take on when pursuing a project, without lowering the firm's credit rating.

Determinants of debt capacity:

- Volatility of cash flows
- Contribution to firm diversification
- Grade of flexibility of conversion assets $< - >$ cash

6 Enterprise Valuation

6.1 DCF with Gordon Growth and Hybrid Approach

$$\text{Enterprise Value} = \text{PV(CF during PP)} + \text{PV}(\text{TV}_t)$$

$$\text{PV(CF during PP)} = \sum_{t=1}^{PP} \frac{\text{FFCF}_t}{(1 + \text{WACC})^t}$$

$$\text{TV}_t = \frac{\text{FFCF}_t * (1 + g)}{(\text{WACC} - g)} \qquad \text{Gordon Growth Model}$$

$$\text{TV}_t = \text{EBITDA}_t * \text{EBITDA Multiple} \qquad \text{Relative Valuation}$$

6.2 Disadvantages of WACC

Implicit assumptions:

- Risks of cash flows do not change over time
- Company maintains steady capital structure

6.3 Adjusted Present Value

$$\begin{aligned}\text{EV}_{\text{APV}} &= \text{Unlevered EFCF} + \text{Interest Tax Savings} \\ &= \sum_{t=1}^{PP} \frac{\text{Unlevered EFCF}_t}{(1+k_u)^t} + \sum_{t=1}^{PP} \frac{\text{I} * T}{(1+k_d)^t} + \text{PV(Terminal Value)}\end{aligned}$$

- Use k_d (firms borrowing rate) as discount factor for Interest Tax Savings
- Use k_u as discount factor for PV(TV), but calculate TV itself with WACC (when using Gordon Growth Model)
- $\boldsymbol{k_u}$: Cost of equity of unlevered firm

Decompose total enterprise value into value from unlevered EFCF and value from financing.

7 Multiples

$$\text{Sales multiple} = \frac{\text{Enterprise Value}}{\text{Sales}}$$
$$\text{EBITDA multiple} = \frac{\text{Enterprise Value}}{\text{EBITDA}}$$

8 Comparables

$$\frac{\text{EV}_{\text{peer}}}{\text{EBITDA}_{\text{peer}}} = \frac{\text{EV}_{\text{target}}}{\text{EBITDA}_{\text{target}}}$$
$$\frac{\text{Price / Share}_{\text{peer}}}{\text{Earnings / Share}_{\text{peer}}} = \frac{\text{Price / Share}_{\text{target}}}{\text{Earnings / Share}_{\text{target}}}$$

9 Real Options

Volatility σ, **Timestep** t

$$\text{Risk neutral probability q} = \frac{e^{rt} - d}{u - d}$$

$$\text{Upstep u} = e^{\sigma\sqrt{t}}$$

$$\text{Downstep d} = \frac{1}{u}$$