Problem set for Finance and Financial Markets, week 6

Alexander Parkhomenko, MIF Full Time, Student ID: 5812429*

Prof. Dr. J.Ligterink, Prof. Dr. L. Phalippou

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1 Question 1

1.1 Part a

The PV of a project is a perpetuity:

$$PV = \frac{0.260}{r_{project}}$$

In turn, required rate of rerurn for a project ($r_{project}$) is:

$$r_{project} = r_f + \beta_{project} \cdot MRP$$

Where MRP - market risk premium. As the project is twice riskier (in term of systematic risk) than activities, and assets of ABC consist of these activities only, so:

$$\beta_{project} = 2\beta_{activities} = 2\beta_{assets}$$

$$\beta_{assets} = \beta_{equity}\frac{E}{D+E} + \beta_{debt}\frac{D}{D+E} = 1.24$$

$$\beta_{project} = 2.48$$

$$r_{project} = 5\% + 2.48 \cdot 7\% = 22.36\%$$

$$PV = \frac{0.260}{0.2236} = 1.162mln$$

1.2 Part b

Price before announcement:

$$P_0 = \frac{Equity}{N.Shares} = \frac{16mln}{1mln} = 16$$

Price after announcement:

$$P_1 = \frac{Equity + NPV}{N.Shares} = \frac{16mln + 1.162mln - 2mln.}{1mln} = 15.16$$

Announcing a project with negative NPV leads to a price decline of $\frac{16-15.16}{16} = -5.25\%$.

*alex.parkhomenko@par-ma.com www.par-ma.com

2 Question 2

2.1 Part a

The NPV of a project is:

$$NPV = -3 + \frac{0.450}{WACC}$$

where $WACC$ is a weighted average rate of return.

As we have efficient markets and zero taxes, WACC is independent of capital structure. Let's show it more formally:[1]

$$WACC = r_f \cdot \frac{D}{D+E} + (r_f + \beta_{lev} \cdot MRP)\frac{E}{D+E}$$

Here β_{lev} - equity levered beta which is equal to $\beta_{lev} = \beta_{unl} \cdot (1 + \frac{D}{E})$, where β_{unl} - unlevered beta. Let's rewrite the WACC expression using unlevered beta:

$$WACC = r_f \cdot \frac{D}{D+E} + (r_f + \beta_{unl} \cdot (1 + \frac{D}{E}) \cdot MRP)\frac{E}{D+E} = r_f + \beta_{unl} \cdot MRP$$

Finally, we need only unlevered beta for telecommunication business. As a comparable firm we can use Voda. It's unlevered beta is:

$$\beta_{unl} = \frac{\beta_{lev}}{1 + \frac{D}{E}} = \frac{2}{1+1} = 1$$

Hence, WACC is equal to $4\% + 1 \cdot 8\% = 12\%$. That gives positive $NPV = 0.75$ billions. So the Mannesmann should acquire Voda.

2.2 Part b

- **Distribution of returns.** If we know that returns are normaly distributed, than average return are the best linear unbiased estimator. So we should use it to estimate the parameter of return distribution. That's a good rationale for it.
- **Time horizon.** Normallity of returns depends on time horizon of returns. For yearly data returns are almost normal, for monthly or even more high frequency data - it becomes nonormal with heavy tails. For the purposes of estimating long-term market risk premuim (MRP) it is better to use yearly data, not monthly.
- **Short term rates** are more volatile than intermediate-term and long-term rates. There should be a good reason to use them to estimate long-term market risk premium, because, from one hand, investment in equity is a long-term investment. From another hand, maturity of debt (which is used to calculate risk free rate) should match the investment horizon in equity, which is typically more than 5-15 years on average.
- **Forward looking.** We need a forward looking estimator for MRP that would take into account changing in time risk tolerance of investors. Historical average might be a bad aproximization.

[1] MRP-here and later in the text, a market risk premium.

2.3 Part c

Valuation using comps with P/E is done in the following way: first we need to find a comparable company (comp) and use it's $(\frac{P}{E})_{comps}$ ratio as proxy for our company.[2] Then using a forecast for our net income (NI) for the next periods $E\{NI_{t+1}|\Omega_t\}$ [3] we compute a projection for price of equity as follows:

$$E\{P_{t+1}|\Omega_t\} = E\{NI_{t+1}|\Omega_t\} \cdot (\frac{P}{E})_{comps}$$

- **Comparability.** One can hardly find an absolutely comparable company, because it should have the same risk profile, growth pattern, size and accounting standart and policies (like earnings smoothing). So we need adjustments to P/E ratio.
- **It might lead to biases** in valuation when the market, industry or comps are significantly overvalued.
- **Earnings projection.** It is not always clear which time horizon take for forecasting earnings - one year ahead or 5 years ahead. For a long term projection 5 years might be more preferable, but it is less precise.

3 Question 3

3.1 Part a

In order to solve this task we need to imply at least one additional assumption:

- **DFG's debt is riskless.** This assumption implies that DFG's $\beta_{debt} = 0$ and debt holders require only risk free rate for DFG's debt.

As we have efficient markets and zero taxes, WACC is independent of capital structure. So we can use the following equation:

$$WACC = r_f + \beta_{unl} \cdot MRP$$

So, to calculate WACC for furniture division we need only unlevered beta for furniture company (Mobilexx). It's unlevered beta is equal to:[4]

$$\beta_{unl} = \frac{\beta_{lev}}{1 + \frac{D}{E}} = \frac{1.2}{1 + 1.5} = 0.48$$

Hence, WACC is equal to $6.36\% = 3\% + 0.48 \cdot 7\%$

3.2 Part b

If management will implement uniform 10% for all departments, this decision would lead to a bias in selection of projects - company would accept more riskier project with expected return more 10% and not accept profitable low risk - low return projects. Finally, it will result in higher WACC for a company since it invested more in riskier projects.

[2] If there are several companies we need to average their multiples.

[3] Ω_t - information set at time t, $E\{\cdot\}$ - expecation operator.

[4] $\frac{D}{E} = 1.5$ as $\frac{D}{D+E} = 0.6$

3.3 Part c

To estimate an equity beta for a company we can use an econometric approach, where beta is a measure of sensitivity of company excess returns to excess market returns and estimated as:

$$\widehat{\beta} = \frac{\widehat{Cov}(r_{it} - r_{ft}, r_{mt} - r_{ft})}{\widehat{V}(r_{mt} - r_{ft})}$$

This beta' estimate is levered, so in order to split the business risk and financial risk we need to adjust for the leverage the way we did it in part a.

3.4 Part d

Company's beta is driven by business risk - sensitivity to market returns of unlevered firm and financial risk - exposure to a higher debt ratio. We can also rephrase it - beta is driven by the correlation with the market (positevly), company's excess return volatility (positevly) and market excess return volatility (negative), since:

$$\widehat{\beta} = \widehat{\rho_{i,m}} \cdot \frac{\widehat{\sigma_i}}{\widehat{\sigma_m}}$$

3.5 Part e

Incremental cash flows - are those that results from implementing a project and are "cashy" - associated with cash movement.

- **Incremental COGS** should be included as they occur because of the project and requires cash payments.
- **Incremental Taxes** should be included as they occur because of the project and requires cash payments.
- **Incremental Depreciation** should not be included as it is does not require cash movements (not paid, simply expensed).
- **Incremental change in NWC** should be included as it is an investment of additional cash into the project.
- **Already incured research expenses** should not be included as it is a sunk cost.
- **Incremental interest payments** should be included because they are due to the project and are paid.
- **Overheads.** We should include only a part which is attributable to the project, i.e. an increase in overheads due to project implementation.