2.1.3 Cost of Debt Exercise and Answer

Unit: Unit 1 – Treasury Strategy

Module: Module 2 – Risk and return

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Summary: A practical exercise in calculating real terms cost of debt

Keywords: tax, cost of debt, inflation, real terms, nominal terms, thin capitalisation, tax shield

Question

You work for a UK company with debt located in the UK and Germany.

- 65% of your borrowings are denominated in US Dollars and the balance is a local Euro facility in Germany.
- 50% of the debt is located in Germany where thin capitalisation rules mean that you can only get tax relief on 60% of your interest charge.
- UK inflation is 3.5%, US inflation is 2% and German inflation is 2.5%.
- The UK corporate tax rate is 30%, the US tax rate is 20% and the German tax rate is 40%.

  What is your real terms, post-tax cost of debt if you borrow US Dollars at 5% and Euros at 6%?

Student notes:

- First, where is the debt located? This determines the appropriate tax shield, and allows you to calculate the post tax nominal cost of debt per currency, per country.
- Secondly you need to establish the real post tax cost of debt. In the case of debt the most relevant inflation rate is that of the currency, rather than the country in which the debt is held.
- In the case of German debt, consider any restriction of tax relief due to thin capitalisation.
- Finally put this all together (a table will help), scheduling out the post tax real terms costs of each piece of debt. Thus calculate the overall weighted average real terms cost of debt.

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Answer

Firstly, where is the debt located? This determines the appropriate tax shield.

We are told that 50% of the debt is located in Germany (and 50% is in the UK) and that the Euro debt is a local facility in Germany. In addition 65% of the debt is in US dollars with the balance, presumably in Euro.

So, the German debt comprises 35% Euro and 15% US Dollar borrowings and the UK debt is in US Dollars:

The post tax nominal cost of the German Euro debt (for the 60% that is tax relieved) is:

$$K_{d\ post-tax\ G(Euro\ NT)} = K_{d\ pre-tax(Euro\ NT)} \times \left(^{1-t}\text{Germany}\right)$$

$$K_{d\ post-tax\ G(Euro\ NT)} = 6\% \times (1 - 40\%) = 3.6\%$$

The post tax nominal cost of the German Dollar debt (for the 60% that is tax relieved) is:

$$K_{d\ post-tax\ G(USD\ NT)} = K_{d\ pre-tax(USD\ NT)} \times \left(^{1-t}\text{Germany}\right)$$

$$K_{d\ post-tax\ G(USD\ NT)} = 5\% \times (1 - 40\%) = 3\%$$

And the post tax nominal cost of the UK Dollar debt is:

$$K_{d\ post-tax\ UK(USD\ NT)} = K_{d\ pre-tax(USD\ NT)} \times \left(^{1-t}\text{UK}\right)$$

$$K_{d\ post-tax\ UK(USD\ NT)} = 5\% \times (1 - 30\%) = 3.5\%$$

Secondly, you need to establish the real cost of debt. In the case of debt the most relevant inflation rate is that of the currency so, for US Dollars we have:

In the UK:

$$K_{d\ post\text{-}tax\ UK\ (USD\ RT)} = \frac{\left(1 + K_{d\ post\text{-}tax\ UK\ (USD\ NT)}\right)}{\left(1 + i_{US}\right)} - 1$$

$$K_{d\ post\text{-}tax\ UK\ (USD\ RT)} = \frac{(1 + 3.5\%)}{(1 + 2\%)} - 1 = 1.47\%$$

And in Germany, for tax relieved debt:

$$K_{d\ post\text{-}tax\ G\ (USD\ RT)} = \frac{\left(1 + K_{d\ post\text{-}tax\ G\ (USD\ NT)}\right)}{\left(1 + i_{US}\right)} - 1$$

$$K_{d\ post\text{-}tax\ G\ (USD\ RT)} = \frac{\left(1 + 3\%\right)}{\left(1 + 2\%\right)} - 1 = 0.98\%$$

And in Germany, for unrelieved debt due to thin capitalisation:

$$K_{d\ pre\text{-}tax\ G\ (USD\ RT)} = \frac{\left(1 + K_{d\ pre\text{-}tax\ G\ (USD\ NT)}\right)}{\left(1 + i_{US}\right)} - 1$$

$$K_{d\ pre\text{-}tax\ G\ (USD\ RT)} = \frac{\left(1 + 5\%\right)}{\left(1 + 2\%\right)} - 1 = 2.94\%$$

In the case of Euros, we will use the German inflation rate, although there might be an argument for using some sort of Euro average if more data was available

For tax relieved debt:

$$K_{d\ post\ tax\ (Euro\ RT)} = \frac{\left(1 + K_{d\ post\text{-}tax\ (Euro\ NT)}\right)}{\left(1 + i_{Germany}\right)} - 1 = \frac{\left(1 + 3.6\%\right)}{\left(1 + 2.5\%\right)} - 1 = 1.07\%$$

And for unrelieved debt due to thin capitalisation:

$$K_{d\ pre\text{-}tax\ (Euro\ RT)} = \frac{\left(1 + K_{d\ pre\text{-}tax\ (Euro\ NT)}\right)}{\left(1 + i_{Germany}\right)} - 1 = \frac{\left(1 + 6\%\right)}{\left(1 + 2.5\%\right)} - 1 = 3.41\%$$

Assuming that the tax relief on the 60% of the German debt which qualifies for tax relief due to thin capitalisation is applied pro-rata, we can analyse the company's debt as shown in the table below.

Debt	**Proportion by location**	**Proportion by currency**	**Rate (post tax RT)**	**Proportion**
US Dollar - UK	50%	65%	1.47%	50%
US Dollar – Germany. Tax deductible	50%		0.98%	9%
US Dollar – Germany. Non- tax deductible			2.94%	6%
Euro – Germany. Tax deductible		35%	1.07%	21%
Euro – Germany. Non- tax deductible			3.41%	14%

So, putting this all together we get:

$K_{d\,Post\ Tax\ RT} = 1.47\% \times 50\% + 0.98\% \times 9\% + 2.94\% \times 6\% + 1.07\% \times 21\% + 3.41\% \times 14\% =$ 1.7%